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U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY
BULLETIN No. 3

THE
HAWKS AND OWLS
OF THE
UNITED STATES
IN THEIR RELATION TO AGRICULTURE

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U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF ORNITHOLOGY AND MAMMALOGY,
Washington, D. C., October 5, 1892.

SIR: I have the honor to transmit herewith, as Bulletin No. 3 of this Division, a report on the Hawks and Owls of the United States, with special reference to the economic status of the various species, by Dr. A. K. Fisher, assistant ornithologist.

This work was written several years ago, but was withheld from publication until provision could be made for suitable reproduction of the colored illustrations, without which the bulletin would have been of comparatively little value to the class of readers for whose benefit it was specially prepared.

The statements herein contained respecting the food of the various hawks and owls are based on the critical examination, by scientific experts, of the actual contents of about 2,700 stomachs of these birds, and consequently may be fairly regarded as a truthful showing of the normal food of each species. The result proves that a class of birds commonly looked upon as enemies to the farmer, and indiscriminately destroyed whenever occasion offers, really rank among his best friends, and with few exceptions should be preserved, and encouraged to take up their abode in the neighborhood of his home. Only six of the 73 species and subspecies of hawks and owls of the United States are injurious. Of these, three are so extremely rare they need hardly be considered, and another (the Fish Hawk) is only indirectly injurious, leaving but two (the Sharp-shinned and Cooper's Hawks) that really need be taken into account as enemies to agriculture. Omitting the six species that feed largely on poultry and game, 2,212 stomachs were examined, of which 56 per cent contained mice and other small mammals, 27 per cent insects, and only 3½ per cent poultry or game birds. In view of these facts the folly of offering bounties for the destruction of hawks and owls, as has been done by several States, becomes apparent, and the importance of an accurate knowledge of the economic status of our common birds and mammals is overwhelmingly demonstrated.

Respectfully,

C. HART MERRIAM,
Chief of Division.

HON. J. M. RUSK,
Secretary of Agriculture.

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THE HAWKS AND OWLS OF THE UNITED STATES.

INTRODUCTION.

That birds are not only beautiful but that they perform an important economic office is an almost universal belief; and it is also generally admitted that they should be protected by law and their increase encouraged in every way possible. To the farmer, however, it is well known that certain kinds, as crows, robins, blackbirds, rice birds, and some others, are more or less injurious, and at times do great damage to the growing or ripened crops.

When certain birds are known to be harmful to agricultural interests, the farmer has a right to ask that the protection of law be withdrawn from such species, and even that means be taken to diminish their numbers. At first it might seem an easy matter to class birds into two great groups, the injurious species and the beneficial species; but in reality it is very difficult, for however harmful a species may be at one season of the year or in a certain region, it may be quite the reverse at another season or in a different region. Thus the bobolink is one of the most highly-prized visitors in the Northern States, and the damage it does to the crops there is so infinitesimal that this weighs nothing against the attractions of its presence and the beauty of its song; in the Southern States this same bobolink, so changed in plumage as to easily pass under an alias, the rice-bird, does immense damage to the rice crop—a damage which amounts to over a million of dollars a year.

Another example of the beneficial-injurious species is the crow. What farmer needs to be told of the unprincipled conduct of Jim Crow at and immediately after corn-planting time. The ever-present scarecrow bears mute witness to the crow's fondness for corn and his thieving habits. But when the corn is past danger the crow changes from an obnoxious to an exemplary member of bird society, and the war he wages on the cutworm earns him no scanty meed of praise from the grass farmer.

Thus it will be seen that the division of our birds into beneficial and harmful kinds is not the easy task it seems, and that even farmers may differ widely as to the status of a certain kind. However they may fail to agree concerning the species just mentioned and others that might be named, there seems to be but one opinion the broad land over as to the status of the hawks and owls; they at least are believed to be wholly harmful; and not only is the farmer boy encouraged to kill every hawk and owl about the farm and to destroy its nest, but the powers of the law are invoked to offer the incentive of bounties for hawks' and owls' heads.

If this widespread belief in the harmful propensities of these birds is correct, then their wholesale destruction is laudable. If, however, such belief is erroneous, the consequences are mischievous enough.

It is important to observe that all the rapacious birds are slow breeders, and, contrary to popular belief, there is no good evidence that any of them have two broods a year, though of course if the first set of eggs is lost another one will be deposited. There is every reason why they should not raise more than one brood, for notwithstanding the fact that they breed very early in the year, the young grow slowly and remain a long time in the nest. Hence the tax upon the parent birds to secure enough food to satisfy the enormous appetites of their slow-growing progeny is very great, probably twice that made upon the members of any other order of land birds.

State laws, therefore, passed for the destruction of hawks and owls, and offering a bounty on their heads, are very effective, either for good or evil. One of the counties of Pennsylvania paid out in a year over $5,000 for scalps of birds of prey. In the light of the foregoing facts it will readily be understood how long a time it will take to replace these birds, whose destruction cost the State of Pennsylvania so much money, in case their services are wanted. There is no doubt that this State and others which have passed similar laws have made a serious mistake; for it is indisputable that the opinion about hawks and owls, so widespread and popular, is not well founded; and it is the purpose of this bulletin to set forth the results of many years' observations with the view of dispelling the popular illusion regarding the destructiveness of hawks and owls as a class. It may be stated with confidence—

(1) That owls are among the most beneficial of all birds, inflicting very little damage upon the poulterer and conferring vast benefits upon the farmer. The relations which owls bear to agriculture are peculiar and important. Their eyesight, unlike that of hawks, which hunt by day, is by no means so defective in daylight as popularly supposed, but is keenest in the early hours of evening and in early morning. Hunting thus in dim light, their food consists largely of those animals which hawks do not trouble at all, or destroy only in small numbers. The work of owls thus supplements that of hawks and materially assists in preventing an undue increase of many obnoxious rodents. Again, though owls are somewhat migratory they are far less so as a class than hawks, and hence in winter, when the latter have left the Northern States for warmer climes, they remain at home and carry on their incessant warfare against injurious rodents.

(2) That all hawks, with possibly one or two exceptions, are to some extent beneficial to the farmer.

Although the facts concerning the food of hawks and owls are set forth in detail under the several species, a few words are here added on this the most important branch of the subject to the farmer. For convenience of discussion the forty-nine species and twenty-four subspecies of rapacious birds may be separated into four classes, as follows:

(*a*) Those wholly beneficial or wholly harmless.

(*b*) Those chiefly beneficial.

(*c*) Those in which the beneficial and harmful qualities seem to balance each other.

(*d*) Those positively harmful.

The first class (*a*) includes six species: Rough-legged Hawk, Squirrel Hawk, Swallow-tailed Kite, White-tailed Kite, Mississippi Kite, and Everglade Kite.

The Rough-legged Hawk, one of our largest species, seems to feed exclusively upon the smaller rodents, and, as it is found within the United States from October to April, the number of meadow mice it destroys is almost incalculable. It passes under the name of 'Hen Hawk,' and many a luckless Rough-leg is shot for the latter, and perhaps a bounty collected on it, when in fact it never destroyed a hen or chicken in its life.

The statement of Pennant and some of the earlier writers, that it attacks ducks and other birds, lacks confirmation.

The Squirrel Hawk, a near cousin to the Rough-leg, has received its name because of its inordinate fondness for the ground squirrels, which are so terribly destructive to the crops in the far West.

The four kites named above, while not so beneficial to the farmer as the two hawks just mentioned, are harmless to poultry, and feed largely upon reptiles, insects, and snails.

The second class (*b*), those mainly beneficial, includes the greater number of species, and to it belong some of the most widely distributed and best known hawks. It includes the following: Marsh Hawk, Harris' Buzzard, Red-tailed, Hawk, Red-shouldered Hawk, Short-tailed Hawk, White-tailed Hawk, Swainson's Hawk, Short-winged Hawk, Broad-winged Hawk, Mexican Black Hawk, Mexican Goshawk, Sparrow Hawk, Audubon's Caracara, Barn Owl, Long-eared Owl, Short-eared Owl, Great Gray Owl, Barred Owl, Western Barred Owl, Richardson's Owl, Acadian Owl, Screech Owl, Flammulated Screech Owl, Snowy Owl, Hawk Owl, Burrowing Owl, Pygmy Owl, Ferruginous Pygmy Owl, and Elf Owl.

The Marsh Hawk, which heads the list, is also one of the first in economic importance. It is distributed over the entire United States, is abundant almost everywhere, and may be easily recognized by its long, slim form and from the manner in which it beats back and forth over the prairies, marshes, and meadows in search of ground squirrels and mice, of which it annually destroys vast numbers. It would have a secure place in the first class were it not for the fact that occasionally it seizes small birds and, less frequently, a stray chicken. Still the harm it does in this way is inconsiderable compared with the benefits it confers by the destruction of harmful rodents.

The Buzzard Hawks, which include the next nine species, are large and sluggish and too slow of wing to secure such agile prey as wild birds or even poultry. Their staple food consists of small mammals, insects, snakes, toads, and frogs.

The Red-tailed Hawk, in some respects the representative of the group, is one of the best known hawks, and shares with the Red-shouldered Hawk the odious appellation of 'Hen Hawk.' It is not to be denied that both species occasionally attack poultry, but the amount destroyed is so small compared with their other food—mostly noxious animals—that it is scarcely to be considered, except perhaps by the individual farmer whose barnyard happens to be visited by the robber. Moreover, in a large majority of cases the poultry and game secured by these hawks are the less active individuals, which from age, accident, or disease are unable to escape from their attacks.

The Red-shouldered Hawk is probably one of the most omnivorous of our birds of prey—eating with apparent relish the following creatures, which represent as many different classes: Mice, birds, snakes, frogs, fish, grasshoppers, centipedes, spiders, crawfish, earthworms, and snails. At least 65 per cent of its food consists of injurious mammals, and, taking into consideration also the number of insects devoured, the showing is remarkably good for the poor 'Hen Hawk,' especially when less than 2 per cent consists of the food which confers upon it that *sobriquet.* Both these hawks suffer for the misdeeds of others, and are striking examples of the effects of having a bad name.

Swainson's Hawk is another of the *Buteos* which is of great service, warring upon creatures which do injury to crops. Its food is much the same as that of the other hawks of this class, except that insects seem to be eaten in larger numbers. Grasshoppers and crickets are particularly sought after, and on the foothills and plains of the West Swainson's Hawks congregate in large flocks wherever these insects are abundant. Dr. Merriam has estimated that at least 200 grasshoppers are consumed daily by one hawk; and in the course of a month a flock of about 165 individuals, which is a small estimate of the number actually seen together in various localities feeding upon grasshoppers, will destroy 1,000,000 adult insects—a benefit to agriculture which no farmer can fail to appreciate.

When we consider the enormous amount of damage grasshoppers have inflicted in a single season in some of the Western States—Kansas for instance—the great benefit that results from the labors of this and other hawks can not be doubted. Many of the game birds—as the turkey, prairie chicken, sage cock, and quail—devour many grasshoppers;

but these birds are valuable as food, and as a consequence have been nearly exterminated in some States, and their numbers are fast being depleted in all. They can no longer be depended upon as allies of the farmer. The same is true of many animals, like the skunks and foxes, and also snakes, all of which, for different reasons, are killed whenever possible. So it is that their natural enemies having been exterminated or much reduced in numbers, noxious insects, such as grasshoppers, have a chance, when favored by exceptionable seasons, to multiply to an astonishing extent; and so it is that having multiplied to a degree impossible to calculate, they suddenly assume the offensive, and, like an invading army, take possession of the whole country and strip it of every green thing. Surely no more economical method of holding these hordes in check can be desired than the fostering of means already provided by nature. Apparently quite ignorant of the habits of hawks and owls, the legislature of at least one of the Western States—Colorado—some years since passed a bounty act which included these birds. As a result thousands of grasshopper-eating hawks were destroyed at the expense of the State—an expense by no means to be estimated by the number of dollars paid out as blood money; for if the destruction be carried far enough and the birds of prey actually exterminated, there is every reason to believe that sooner or later one of the consequences will be another grasshopper plague.*

The Broad-winged Hawk is another species which feeds to a considerable extent on insects, destroying vast numbers of grasshoppers and crickets. It is especially fond of the larvæ of the large moths which feed on the leaves of fruit and shade trees, and during the late summer and early autumn it is exceptional to find one that has not been indulging in this kind of food. Snakes, toads, frogs, and the smaller rodents also form a considerable portion of its fare. It rarely attacks birds.

The little Sparrow Hawk is the only one of the true falcons which can be placed in the present class, and, although at times it follows the example of its larger congeners and attacks small birds and young poultry, these irregularities are so infrequent compared with its constant good service in destroying insects and mice that they are hardly to be considered. It is, in fact, too small to cope with any but very small chickens. Grasshoppers and crickets form its principal food during the warmer months, while mice predominate during the rest of the year.

Among the owls of this class which deserve special mention the Barn Owl is probably the most important from an economic point of view, and it is questionable whether it should not have been placed in the previous class, as its food is almost entirely made up of injurious mammals. In the West it feeds very largely on pouched gophers, and the stomach contents of the individuals examined and the fragments of food found about its nests reveal traces of very little else than the remains of these rodents. To appreciate properly the services of this owl it must be remembered that the pouched gophers are among the most, if not the most, destructive mammals which inhabit this country. In the South this owl lives largely on cotton rats, another very destructive animal, and at various places it has been found to feed extensively on the common rat.

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* The writer, who passed through the counties of Bent and Logan in July, 1892, saw every indication of the commencement of another grasshopper plague, as myriads of grasshoppers were feeding on the alfalfa and wheat.

The Long-eared and Short-eared Owls feed extensively on mice and sparingly on small birds—mostly grain-eating or seed-eating species, which are of slight economic importance. All of the common species of mice are found among the stomach contents, and as both birds are numerous the service done the farmer is correspondingly great.

The Barred Owl, if any reliance may be placed upon the accounts of earlier writers, feeds largely upon poultry and game, though from more recent investigations it would seem that either the bird has modified its habits or that the statements of their destructiveness are very much exaggerated. Our own examinations, so far as they go, prove that less than 3 per cent of the food of this bird consists of poultry, while a large proportion consists of such rodents as rabbits, squirrels, and various species of rats and mice. It feeds quite extensively also on frogs and crawfish.

The little Screech Owl, so well known in most parts of the country, is indefatigable in its work of destroying mice and insects. It may often be seen at dusk hovering about barns and outhouses watching for mice, or skimming over the fields or along the hedge rows in search of grasshoppers, crickets, and beetles. During the time it is caring for its young it occasionally captures small birds, as well as in winter when hard pressed for food. As an offset, the individuals inhabiting the city parks have learned to feed more or less extensively on the English sparrow, for which good service they should be particularly commended, as the English sparrow has become a most destructive nuisance.

The Burrowing Owl is the only remaining species of this class which will be specially mentioned. During the warmer parts of the year it feeds extensively on scorpions, centipedes, grasshoppers, crickets, and various species of beetles, as well as on mice and ground squirrels. Few birds are destroyed by it. Occasionally when other food is scarce, especially in the northern part of its range in winter, it is forced to prey upon small birds, from necessity rather than choice. There is no excuse whatever for destroying this owl and it should be protected by law.

The third class (*c*) includes those birds whose beneficial and noxious qualities about balance one another. As was said above of birds generally, so it may be said of hawks and owls, that frequently a species which in one place is properly to be considered noxious from its predatory visits to the farmyard or because of attacks on game and song birds, in another locality may be of immense value on account of its service in destroying injurious mammals or insects. For example, the Great Horned Owl, which in the East is persistent in its attacks on poultry and game, in the rabbit-infested portions of the West destroys such immense numbers of these rodents that its assistance is invaluable to the farmer. The above statement applies with greater or less force to the following species, which are included in the third class: Golden Eagle, Bald Eagle, Pigeon Hawk, Richardson's Hawk, Aplomado Falcon, Prairie Falcon, and Great Horned Owl.

The Bald Eagle and Golden Eagle may be considered as beneficial to the agriculturist in parts of the country where rabbits, prairie dogs, or gophers are common, but in sections where sheep are extensively raised they are often very injurious.

The latter species, our National Bird, by preference eats fish and is a successful fish-catcher when it can not get the Fish Hawk to do its fishing for it. It also feeds extensively on dead fish which have washed ashore. In some localities, especially in the South, it is destructive to waterfowl, killing any and all of the species, from swans and geese down to the smaller ducks and coots. However, as it has been chosen for our national emblem, we should not begrudge it a livelihood and may, perhaps, allow it to choose what it will in the way of wild game.

The Prairie Falcon, whose fondness for many of the ground squirrels causes it to follow them relentlessly, in this way nearly, if not quite, balances the harm it does by destroying waterfowl and upland game as well as insectivorous birds.

The Pigeon Hawk, Aplomado Falcon, and Richardson's Merlin are true falcons, whose food consists of birds of various kinds, but they consume enough injurious insects and mammals to partially offset the harm done.

The fourth and last class (*d*) includes those species which feed mainly on animals that subserve a useful purpose to man and do not to any appreciable extent destroy noxious animals. The following species are included in this class: Sharp-shinned Hawk, Cooper's Hawk, Goshawk, Duck Hawk, the Gyrfalcons, and Fish Hawk.

Fortunately the Goshawk is comparatively rare in most farming districts of the United States, as it is a bird of the far North; otherwise its destructiveness to poultry would be very great. Few species are more fond of poultry and game, and its large size enables it to carry off with ease a full-grown chicken. Ruffed grouse too often fall a prey to it, and on account of its partiality to this bird it is known as 'Partridge Hawk' in some parts of the country. In fall and winter it captures a considerable number of squirrels and rabbits and with ease strikes down a full-grown northern hare.

Cooper's Hawk is a common species in suitable localities throughout the United States and southern Canada. Much of the ill-favor with which birds of prey as a whole are looked upon is due to the depredations of this, the true 'Chicken Hawk,' together with those of its smaller congener, the Sharp-shinned Hawk. Both species feed almost exclusively on the flesh of either domesticated or wild birds. When they find a farm where chickens can be captured with impunity they make daily excursions to it, and unless killed will sometimes nearly depopulate the yard. Domesticated pigeons are particularly sought after by Cooper's Hawk, and when a keen-eyed individual once locates a cote the destruction to the inmates is great. Quails and young grouse are also favorite food of both of these hawks.

In one direction their fondness for the flesh of birds promises to be of great benefit to the country, namely, in the destruction of English sparrows. Both of these hawks have learned from experience that a desirable food and one easy to obtain is to be found in the towns, hence it is not an uncommon sight, even in the streets of our large cities, to see one of them dash into a flock of sparrows. This, however, is the only benefit conferred upon mankind by Cooper's and the Sharp-shinned Hawks, for they very rarely attack mammals and insects. Their small size, daring, and rapid flight render them easily recognizable, and they need seldom be mistaken for their innocent relations. Unquestionably both species should be destroyed whenever and whenever possible.

The Gyrfalcons, the largest and most powerful of the true falcons, are rarely seen within our borders, and then only in winter. They feed largely upon ptarmigan, grouse, waterfowl, hares, and poultry when the latter is available, and occasionally on small mammals.

The Duck Hawk is another powerful falcon, and one closely related to the famous Peregrine Falcon of the Old World, which was used so extensively in falconry in 'ye olden time.' As its name implies, it is a persistent follower of waterfowl and, when these are available, it takes little else as food. In default of waterfowl it will attack poultry and, in fact, birds of any sort even down to the smallest insectivorous species. Like others of the class, little can be said in its favor. Fortunately for the poultry yards and game coveys this falcon is rare in most parts of the United States; in fact the Sharp-shinned and Cooper's Hawks are the only two of the destructive species which are at all common throughout the greater part of the United States and southern Canada.

The Fish Hawk, although a magnificent bird and one that lends attractiveness to many a scene by sea and river, can not be classed as a useful species, from an economic standpoint. It eats fish, and fish only, and is often a nuisance to the fish culturist. Moreover, while unquestionably its food is largely comprised of the inferior species of fish, some of the most useful kinds, as trout, bass, mullet, and others fall victims to its splendid powers as a fisher. If its fine presence and magnificent flight do not sufficiently plead in its favor, then it must be put on the black list.

It will be seen from the above that of the rapacious birds with which our country is so well furnished, there are but few which deserve to be put on the black list and pursued without mercy. The greater number either pass their whole lives in the constant performance of acts of direct benefit to man or else more than make good the harm they do in the destruction of insectivorous birds and poultry by destroying a much greater number of animals well known to be hostile to the farmer.

The birds of prey are all peculiarly fitted by nature to play their parts in the maintenance of the balance in the animal world. Possessed of amazingly acute eyesight, strong bills for tearing their prey, sharp talons that lock with a never-failing clutch and insure the speedy death of a victim by piercing its very entrails, added to ample and enduring powers of wing, they must be admitted to be well equipped for their occupation. They are all great eaters, and when the supply of food is unlimited are gorged during most of the time. Their digestion is very rapid and their assimilation perfect; consequently the amount of food a bird consumes each day in relation to its own weight is very great. It is well that it is so, for the habit of taking more food than is necessary for their immediate needs enables them to store up force for future emergencies and preëminently fits them for the work of keeping nature's balance true. They are required at times, from inclement weather or other causes, to withstand great exposure and long protracted fasts, which they do with little inconvenience.

In the case of the birds of prey, as in some of the other orders, the indigestible portions of food, such as feathers, hair, bones, and the hard coverings of insects, are formed into balls by the movements of the stomach, after the nutritious portions have been absorbed. These masses, which are known as 'pellets,' are regurgitated from the stomach before a new supply of food is taken. The movements of the stomach so shape these 'pellets' that every sharp piece of bone or hard material which might otherwise injure the mucous membrane is carefully enveloped by a felty covering of hair or feathers. In the case of some of the owls which have regular roosting places vast numbers of these pellets collect, and an examination of them will give a perfect index to the character of the food devoured.

No less than 2,690 stomachs have been examined in the preparation of this bulletin, and the contents are enumerated in the tables accompanying the species. Of these, 169 contained the remains of poultry and game birds; 463, of other birds; 966, of mice; 397, of other mammals; and 623, of insects. If the stomachs of the six species which feed very largely upon game and poultry are eliminated we have a total of 2,212 stomachs. Of these 78, or 3½ per cent, contained the remains of poultry or game; 257, or 11 per cent, of other birds; 945, or 42½ per cent, of mice; 309, or 14 per cent, of other mammals; and 599, or 27 per cent, of insects.

As this bulletin is intended to be of practical benefit to the farmer descriptions are given of all our birds of prey by which he may tell his friends from his foes, that he may preserve the former and destroy the latter. These descriptions have been made as short and as terse as is compatible with clearness and have been stripped of all technicalities. Some little explanation is needed in reference to measurements: *Length* means the total length of fresh specimens from end of bill to tip of tail. *Extent* is also taken from fresh specimens and is measured from the tip of one wing to that of the other, they being moderately stretched. The wing measurement may be from a dried skin and is taken from the bend of the wing to the end of the longest feather. The *Tail* measurement is taken from the tip of the longest feathers to the back part of the eminence of the oil sac. Moreover, to insure the correct identification of the several species, figures of the more important have been added. By means of the descriptions and figures it is believed that the farmer may readily become acquainted with the birds here treated of. For the benefit of those whose interest in the subject extends beyond its economic side, a short account of each species is added, with some particulars of their nesting habits, etc. The nomenclature adopted is that of the American Ornithologists' Union. The geographical races, or subspecies, are included under the typical species, since the habits of both are practically identical, the main differences between them being color and to a less extent size.

In closing, the writer wishes specially to express his indebtedness to Mr. H. W. Henshaw, who has assisted him in various ways in the preparation of the present bulletin. He also wishes to acknowledge his obligations to Dr. E. A. Mearns, U. S. Army, who kindly placed in his hands original data on the food of several hundred hawks and owls.

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SWALLOW-TAILED KITE.

Elanoides forficatus.

[Plate 1—Two adults.]

The Swallow-tailed Kite is an inhabitant of the tropical and warmer portions of America, extending north in the United States regularly to Iowa, Minnesota, Illinois, Kentucky, and Virginia, and west to the Great Plains. It has occurred casually in Pennsylvania, New York, southern New England, and Ontario. In the United States the species is most abundant in the States bordering the Gulf, but becomes more and more uncommon toward the limits of its range at the north. Although a few birds may occasionally remain in southern Louisiana and Texas, and regularly in southern Florida, the majority cross our southern border about the 1st of October to spend the winter in Central and South America, and are not seen again until the 1st of the following April. A most extraordinary exception to this usual migration is given by Dr. C. E. McChesney, who found the species near Fort Sisseton, S. Dak., during nearly the whole winter of 1877–'78. (Bull. Nutt. Ornith. Club, vol. III, 1878, p. 147.) On November 17, 1881, Mr. D. H. Talbot saw a flock of fifty or more between Jamestown and Bismarck, N. Dak. (Bull. Nutt. Ornith. Club, vol. VII, 1882, p. 59.)

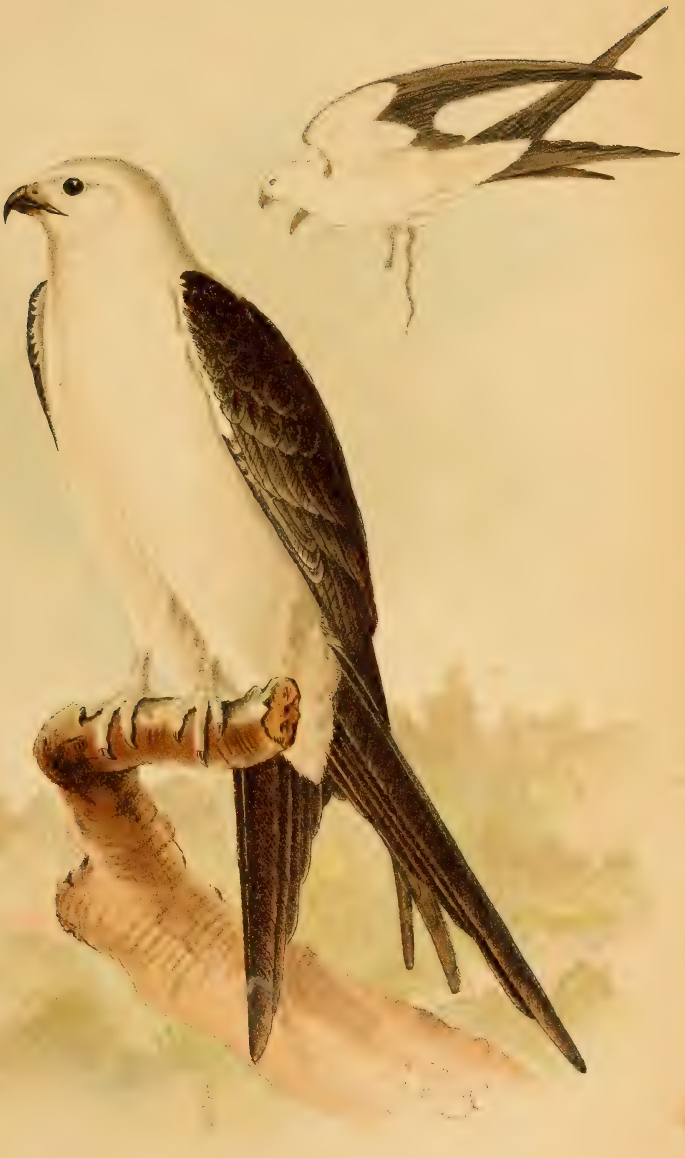
The principal food of this Kite is small snakes, lizards, frogs, and various kinds of insects. It never molests small mammals or birds. Among insects it is especially fond of wasp larvæ, grasshoppers, and dragon flies; and its power to change the direction of flight is most markedly shown in capturing the latter insects, for in its efforts to secure them it is often necessary for it to turn almost completely over in its evolutions.

In Florida Dr. C. Hart Merriam often saw these Kites dart down and pick a wasp's nest from the under side of a leaf of some high palmetto and fly off with it, devouring, while on the wing, the grubs it contained. (Am. Nat., vol. VIII, 1874, p. 88.)

Mr. H. Nehrling speaks of the birds' food in Texas as follows: "In August and September the birds are often seen in cotton fields, where they feed on cotton worms and other insects. They are particularly fond of small snakes, such as *Leptophis*, *Rhinostoma coccinea*, lizards (*Anolius carolinensis* and *Ameiva sex-lineata*). I have never seen them take a bird or a small quadruped." (Bull. Nutt. Ornith. Club, vol. VII, 1882, p. 173.)

Audubon speaks of frequently seeing them with long slender snakes hanging from their talons. The following is his account of an examination of two stomachs collected in Texas: "In the stomach [of one bird] are six snakes, of a very slender form, and light-green color, one of them 22½ inches in length, together with one large larva, 3 inches long, and two coleopterous insects. Some of the snakes have been swallowed whole, Bull. No 3 Div. Ornithology

Plate I.



SWALLOW-TAILED KITE.

although bruised, the rest broken into large pieces several inches long. * * * In another male shot in the same country, on the same day, the stomach contained a slender snake 19 inches long, six lizards, and four beautiful, very large coleopterous insects, with two eggs of reptiles 7½ twelfths long." (Ornith. Biography, vol. v, pp. 372–374.)

Mr. Henshaw informs me that he found these Kites common on the Miami River, southeast Florida, and frequently saw them in mid air feeding upon snakes, which appeared to be their favorite food in that locality.

Glancing over the bill of fare of this Kite, it will at once appear that while there are many of the rapacious birds which perform greater service to the farmers in the destruction of his foes, there are few which are less injurious. The snakes, lizards, and frogs it destroys, though by no means injurious to agriculture, probably will be regretted by few, while the insect food, especially the grasshoppers and cotton worms, not only can be spared, but their destruction may be considered a positive benefit.

It probably breeds in suitable localities throughout its range, even to the northern limit. Its nest has been taken in Minnesota, and according to a very interesting note by Mr. Austin F. Park, it is very probable that a pair bred in Rensselaer County, N. Y., in 1886. (The Auk, vol. III, p. 484.) In the southern part of the United States this species begins to breed about the last of April or first of May, while farther north it is past the middle of the latter month before a full complement of eggs is deposited. The nest is situated in the tops of the tallest trees and is placed among the smaller branches, where it is well hidden by the thick foliage. Occasionally it is built toward the end of a large limb, 20 feet or more from the main trunk, the supporting branch usually being not more than a few inches in diameter. The nest oftentimes is a rude structure, made of sticks only, and resembles closely in appearance that of some of the herons, while others are more substantial, from the lining of Spanish moss or soft inner bark of the cottonwood which they contain; rarely a nest is composed almost entirely of Spanish moss.

The number of eggs in a set is usually two, though three, four, and probably even more are sometimes deposited. Audubon found a nest near the Falls of the Ohio, in 1820, which contained four young. The male is very attentive and assists the female in building the nest and incubating the eggs, as well as in collecting a large proportion of the food for the young. After the breeding season this Kite is more or less gregarious; families of four or five are usually found together and occasionally flocks of fifty or more. This species is quite wary and difficult to approach, but if one of a flock is killed or wounded the others will fly around it, and a number may be secured before they take alarm and move off.

The flight is smooth and protracted, and for grace and elegance is not excelled by that of any other species. To fully appreciate its superiority one must see the bird on the wing, for no language can describe the beauty of the ever-varying movements. No matter whether the bird is soaring far above the earth, skimming lightly over its surface, or following the different gyrations of some fleeting insect, the observer is surprised as well as charmed at the wonderful exhibition. Often it will stop in mid air, and with half-closed wings and depressed tail shake itself much after the manner of swallows while bathing. Although it often alights on trees it rarely is seen on the ground, and even when capturing its prey it glides swiftly over the surface, reaching down at the proper moment to secure the quarry. It generally, if not always, feeds while in mid air, bending its head downward and toward the talons to tear the object in its grasp. It drinks while skimming rapidly over the surface of the water as do the swifts, swallows, and many other birds.

DESCRIPTION.

Tail deeply forked, the outside feathers being more than twice as long as the middle pair; wings very long, narrow, and acute.

Color: Head, neck, lower parts, under wing feathers, and band across rump, pure white; back, wings, and tail glossy blackish.

Length: 19.50 to 25.50 inches (495 to 647 $^{\text{mm}}$); extent 45 to 50 inches (1143 to 1270 $^{\text{mm}}$); wing 15.50 to 17.75 inches (393 to 451 $^{\text{mm}}$); outer tail feathers 12.50 to 14.50 inches (317 to 368 $^{\text{mm}}$).

Table showing the results of examinations of 6 stomachs of the Swallow-tailed Kite (Elanoides forficatus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Hawkinsville, Fla	Mar. 31, 1885	....	....	....	Lizard, grasshoppers, tree toad, beetles.
Do	do	....	....	....	Lizard, grasshoppers, beetles.
Dixon County, Nebr	June, 1865	....	....	....	60 locusts, 5 other insects.
Do	do	....	....	....	69 locusts, 3 other insects.
Sarpy County, Nebr	Sept., 1873	....	....	....	75 insects.
Woodville, Minn	April 28, 1888	....	....	....	Beetle, wasp.

Summary.—Of 6 stomachs examined all contained insects; 2, lizards; 1, tree-frog.

WHITE-TAILED KITE.

Elanus leucurus.

The White-tailed Kite inhabits the tropical and subtropical portions of America, except the West Indies, and extends north into the United States regularly to about latitude 38° along the Pacific coast, and to 35° in the central and eastern portions. A few probably winter in Louisiana and Texas, while the species is a regular resident in the southern part of California, though, strange to say, it has never been recorded from Arizona or New Mexico.

The food of this Kite, like that of the swallow-tailed, consists of small snakes, lizards, frogs, and such insects as grasshoppers and beetles. Audubon states that he found the remains of birds in two stomachs he examined, which is an experience no other naturalist has shared with him so far as known.

About the first of April it begins to remodel its old nest or that of some other bird, or builds a new one. The structure is usually placed among the slender branches in the top of some lofty sycamore or live oak, in the vicinity of water. It is flat, with a very shallow concavity, and is composed of small sticks, with an occasional lining of grass. By the middle of April full complements of eggs are usually to be found; these vary from three to five in number.

In the United States it is said to live in pairs or small families but never singly, though in South America Mr. W. B. Barrows informs me he never saw more than one at a time. It frequents the lowlands, where it rapidly beats back and forth over the surface of the ground, ever ready to seize its prey. The species is tame and unsuspicious, and may be approached without difficulty. Its flight is very much like that of the Mississippi Kite, but usually is not so protracted, nor does the bird attain such an elevation as the latter species.

DESCRIPTION.

Front of bare leg covered with minute roundish scales; claws not grooved beneath.

Color: Above, pale bluish gray, becoming gradually white on head and tail; shoulders and a spot in front of the eyes black; below, entirely pure white.

Length: 15 to 16.75 inches (380 to 425 mm); extent, 39 to 42 inches (990 to 1066 mm); wing, 11.50 to 13.50 inches (292 to 342 mm); tail, 5.90 to 7.40 inches (150 to 188 mm).

Table showing the results of an examination of 1 stomach of the White-tailed Kite (Elanus leucurus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Stockton, Cal				Meadow mouse	

MISSISSIPPI KITE.

Ictinia mississippiensis.

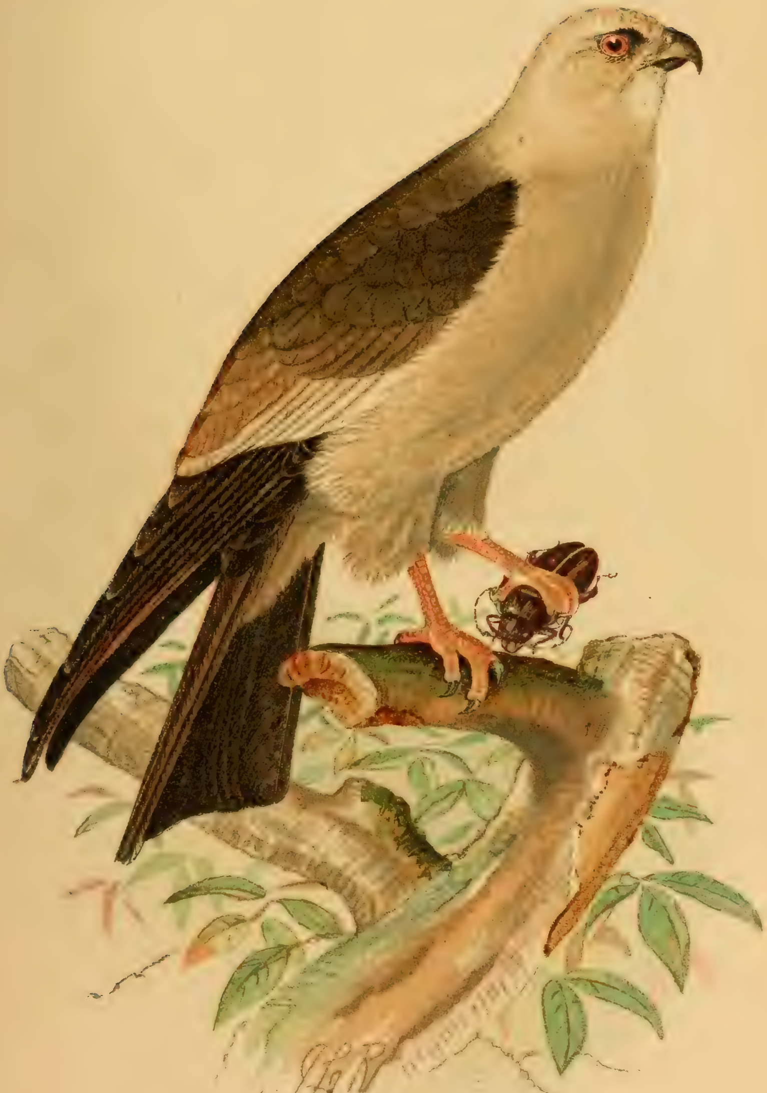
[Plate 2—Adult.]

The Mississippi Kite, like the other American species, inhabits the more southern parts of our territory. It is distributed from Guatemala north through eastern Mexico and the southern United States east of the Rocky Mountains, occurring regularly as far north as Georgia, southern Illinois, Indian Territory, and Kansas, and casually to Iowa and Wisconsin. A few remain in the southern United States all winter, but the greater part pass on to Mexico during October, and return again in the latter part of April.

The food of this species, like that of the Swallow-tailed Kite, consists of insects, such as the larger beetles, grasshoppers, and locusts, lizards, small snakes, and frogs. It never has been known to molest birds or mammals, except to drive the larger species away from the vicinity of its nest. Three specimens which Wilson examined at Natchez, Miss., contained the remains of beetles; and he saw them flying about the trees feeding on cicadas. Dr. Coues mentions one shot at Bluffton, S. C., whose stomach was crammed with the same insects, together with a few katydids. It is wonderful at what a distance its keen eyes can detect a comparatively small insect. Mr. E. W. Nelson says: "I saw them repeatedly dart with unerring aim upon some luckless grasshoppers from an elevation of at least 100 yards." (Bull. Essex Inst., vol. IX., 1877, p. 58.)

As regards the economic value of this Kite much the same statement may be made as of the previous species. It does little or no damage, but much good. Soon after arriving in its summer home it begins to remodel its old nest or the deserted nest of some other bird, and more rarely, when these are not available, it builds a new one. The remodeling consists in patching up the sides with a few sticks and adding a sparse lining of Spanish moss or green leaves. The nest is usually situated in the tops of the tallest trees, among the smaller branches, where it is well concealed by the foliage. The full complement of eggs, usually two or three in number, is deposited by the middle of May, though in some cases it must be much earlier, for the writer once secured a young bird in southern Louisiana the last of May which already had acquired nearly the adult plumage.

This Kite is not at all shy, and may be secured easily as it sits on some tall stub; in fact, Col. N. S. Goss tells of shooting a pair from the same tree, as the second one did not move at the report of the gun, but looked down with surprise on its fallen companion. It is said to be morose and irritable in captivity and very difficult to tame. A specimen which the writer once wounded was the very picture of rage as with flashing eyes and erect crest it threw itself on its back and prepared to repel the aggressor with its talons.



MISSISSIPPI KITE.

Ictinia mississippiensis (Wils.)

This species is fully as gregarious as any of the other Kites, and often times may be seen in flocks of twenty or more circling over a favorite hunting ground. It is observed most frequently around the border of woods in the vicinity of water, and is particularly fond of half-cleared ground where dead trees still stand, these being used for perches.

Its flight is as varied and graceful as that of the Swallow-tailed Kite, is long protracted, and the bird often ascends to so great a height as to be barely visible. While soaring high in the air its flight simulates that of the turkey buzzard very closely, and as the two birds often are seen together the Kite looks like a miniature of the other.

DESCRIPTION.

Front of bare leg covered with large transverse scales; cutting edge of upper bill notched.

Color: Uniform bluish gray or lead color, becoming lighter on head and darker on wing and tail; inner webs of outer wing feathers partly rufous.

Length: 13 to 15.50 inches (330 to 393 $^{\mathrm{mm}}$); extent, 35 to 37 inches (890 to 940 $^{\mathrm{mm}}$); wing, 10.60 to 12.30 inches (269 to 312 $^{\mathrm{mm}}$); tail, 6 to 7 inches (152 to 178 $^{\mathrm{mm}}$).

Table showing the results of examinations of 4 stomachs of the Mississippi Kite (Ictinea mississippiensis).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Madisonville, La	May 29, 1886				Fragments of insects.
Do	May 30, 1886				Beetles.
Breckenridge, Tex	May 5, 1889				Grasshoppers, beetles, other insects.
Ponca Agency, Okla	Aug. 5, 1892				5 katydids, 3 grasshoppers, 1 cricket.

SUMMARY.—Of the 4 stomachs examined all contained insects.

EVERGLADE KITE.

Rostrhamus sociabilis.

This Kite inhabits the whole of tropical America, excepting parts of the West Indies, and passes our southern border into Florida only. Through many parts of the everglades this bird is common, generally associating in flocks of from five to eight or ten individuals.

Its food, as far as known, consists exclusively of fresh-water univalve mollusks, which it finds among the water plants at the edges of shallow lakes and rivers or the overflowed portions of the everglades. The species it feeds on in Florida (*Ampullaria depressa*) is of moderate size, the shell being 2 or 3 inches in diameter, and is very abundant in suitable localities through the middle and southern parts of the State. When the bird has captured one of these mollusks it flies to the nearest perch and removes the meat from the shell with apparent ease and without injuring the latter. While collecting food it often secures five or six before returning to the nest, keeping in its gullet the parts it has extracted for the young.

So far as at present known the Everglade Kite can not be said to have any economic value, since the mollusk, which appears to constitute its sole food, does not seem to be in any way injurious. If not positively beneficial, however, it at least may be claimed for this kite that it does absolutely no injury to man, and consequently should never be wantonly destroyed.

By the first of March, or in some cases a little sooner, it begins to build. The nest is usually situated in some low bush or among a dense growth of saw grass, rarely if ever more than a couple of feet above the water. It is a flat structure, often composed of small sticks loosely placed together and sometimes receives an incomplete lining of dry saw grass. The eggs are two or three in number, two being more common. It is a very unsuspicious bird and may be approached easily while on a perch, or may pass within close range of a person as it beats over the meadows. Its flight is said to resemble more closely that of the Marsh Hawk than that of any other of the rapacious birds.

DESCRIPTION.

Upper part of bill forming a slender lengthened hook. Five outer wing feathers cut out on the inner web.

Color: Uniform slate color, becoming nearly black on outer wing feathers and tail; head and neck with more or less of a chalky cast; base of tail and feathers covering it, white.

Length: 16 to 18 inches (406 to 457 ^{mm}); extent, 44 to 46 inches (1117 to 1168 ^{mm}); wing, 12.90 to 14.25 inches (328 to 362 ^{mm}); tail, 7.20 to 8.50 inches (182 to 216 ^{mm}).

MARSH HAWK.

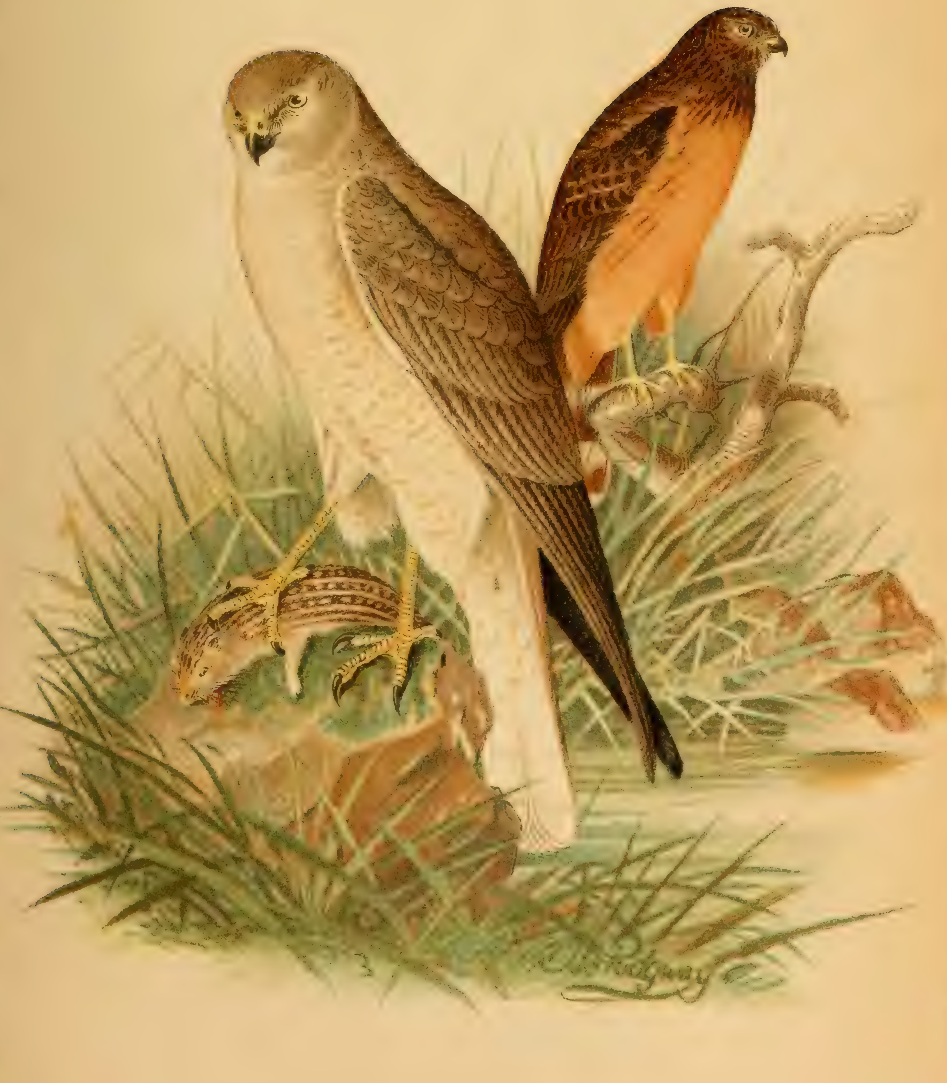
Circus hudsonius.

[Plate 3—Adult male, immature female.]

This well-known hawk inhabits the whole of North America, breeding north to Alaska and the fur countries, and wintering from about latitude 40° N., southward to Panama and Cuba. A representative species (*Circus cyaneus*) occurs throughout most of temperate Europe and Asia, wintering in the more southern portions as well as in northern Africa.

The Marsh Hawk breeds in suitable localities everywhere from the southern border of the United States to the northern limits of its range, but is most common through the prairie country of the West. In the

Bull. No 3. Div. Ornithology. [illegible]



MARSH HAWK

[illegible]

case of a species of such extended distribution the time of nesting is very variable. Thus while in Texas the eggs are to be found by the latter part of April, in the fur countries it is the middle of June before they are deposited.

The nest is always placed on the ground, usually in a marsh or prairie grown up with tall rushes, grass, or bushes, and not far from water. It is commonly situated at the base of a bush, or, in localities subject to inundation, on the top of a tussock. It is composed chiefly of dry grass loosely thrown together and strengthened by the incorporation of a few dead sticks, and as a finishing touch a sparse lining of feathers is added. When the same site is used for several years in succession the accumulated mass of material often forms a platform of considerable size.

The number of eggs in a set is usually from four to six, though as many as eight have been found. As with most of the hawks, the period of incubation is nearly four weeks. The male assists the female in the construction of the nest, in incubating the eggs, and in procuring food for the young. During the period in which the young are being fed the male often drops the food to the female from a considerable height, as he passes near the nest, she darting upward and catching it before it reaches the ground.

This hawk is very zealous in protecting its young from intruders and has been known to attack persons or dogs who have entered its domain. After the young are reared and leave the nest they remain together, and as fall advances several families unite and migrate southward. Hence it is not unusual to see forty or fifty individuals at one time scattered over the more extensive marshes.

Though the flight of this hawk lacks the elegance of some of the other species, it is well sustained and often protracted. When the bird is beating back and forth over the meadows in search of food the flight is easy, regular, but not rapid, and resembles closely that of some of the herons. In the spring the male sometimes goes through a series of aërial evolutions which are highly amusing. While at a considerable altitude it throws its wings over its back, and falling several yards turns over and over much like a tumbler pigeon until near the ground, when it ascends rapidly again to repeat the performance.

When prey is discovered the hawk poises for a moment over the spot and then drops quickly on it, and if unsuccessful is sure to beat over the same place before leaving. It generally devours its quarry on or near the spot where captured, instead of carrying it away. Its food consists largely of small rodents, such as meadow mice, half-grown squirrels, rabbits, and spermophiles or ground squirrels. In fact, so extensively does it feed on the last-named animals that the writer rarely has examined a stomach from the West which did not contain their remains. In addition to the above it preys upon lizards, frogs, snakes, insects, and birds; of the latter, the smaller ground-dwelling species usually are taken. When hard pressed it is said to feed on offal and carrion; and in spring and fall, when water fowl are abundant, it occasionally preys upon the dead and wounded birds left by gunners. It seldom chases birds on the wing, though the writer has seen it do so in a few instances.

In speaking of the food of the Marsh Hawk, Audubon says: "The food of the Marsh Hawk consists of insects of various kinds, especially crickets, of small lizards, frogs, snakes, birds, principally the smaller sorts, although it will attack partridges, plovers, and even green-winged teals, when urged by excessive hunger." (Ornith. Biography, vol. IV, p. 400.)

Mr. H. W. Henshaw, whose great field experience in the West enables him to speak authoritatively on the subject, says: "They were seen at all hours of the day * * * in search of mice and gophers, which, when obtainable, constitute the major part of its food. When urged by hunger, it may attack birds; and I remember to have been once robbed of a widgeon I had killed and kept lying in the water, by one of these birds; but generally they confine their attacks to the humblest kind of game, which possess neither the strength to enable them to resist nor the activity to evade the sudden descent of their winged enemy." (Ornith. 100 Merid., 1875, p. 416.)

Dr. Coues says: "It ordinarily stoops to field mice, small reptiles, and insects. It is particularly fond of frogs." (Birds of the Northwest, p. 331.)

Mr. Ridgway, in the Ornithology of the Fortieth Parallel (p. 580), states that the stomachs and crops of specimens killed at Pyramid Lake, Nev., were filled to their utmost capacity with the remains of small lizards, and nothing else.

Dr. B. H. Warren gives the following summary of his investigations on this species: "In fourteen examinations made by myself, seven hawks had only field mice in their stomachs; three, frogs; two, small birds (warblers); one, a few feathers, apparently of a sparrow (*Melospiza*), and fragments of insects; one, a large number of grasshoppers, with a small quantity of hair, undoubtedly that of a young rabbit." (Birds of Pennsylvania, 1888, p. 75.)

There is another way in which it protects crops, albeit unconsciously, as appears from the following: "It is also said to be very serviceable in the Southern rice-fields in interrupting the devastations made by swarms of bobolinks. As it sails low and swiftly over the fields it keeps the flocks in perpetual fluctuation and greatly interrupts their depredations. Wilson states that one marsh hawk was considered by the planters equal to several negroes for alarming the rice-birds." (Hist. N. A. Birds, vol. III, p. 218.)

Dr. Merriam bears witness to the truth of the foregoing, for while at Georgetown, S. C., he saw an immense flock of bobolinks driven from a field by one of these hawks, which simply passed over at a considerable height, and made no movement to molest them.

Although this Hawk occasionally carries off poultry and game birds, its economic value as a destroyer of mammal pests is so great that its slight irregularities should be pardoned. Unfortunately, however, the farmer and sportsman shoot it down at sight, regardless or ignorant of the fact that it preserves an immense quantity of grain, thousands of fruit trees, and innumerable nests of game birds by destroying the vermin which eat the grain, girdle the trees, and devour the eggs and young of the birds.

The Marsh Hawk is unquestionably one of the most beneficial as it is one of our most abundant Hawks, and its presence and increase should be encouraged in every way possible, not only by protecting it by law, but by disseminating a knowledge of the benefits it confers. It is probably the most active and determined foe of meadow mice and ground squirrels, destroying greater numbers of these pests than any other species, and this fact alone should entitle it to protection, even if it destroyed no other injurious animals.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Arvicola riparius.
Arvicola pinetorum.
Thomomys.
Spermophilus 13-lineatus.
Spermophilus 13-lineatus pallidus.
Spermophilus mollis.
Neosorex.
Sigmodon.
Lepus sylvaticus.
Tamias minimus.
Sorex.
Blarina exilipes.
Mephitis.
Sciurus hudsonicus.
Perodipus ordii.

BIRDS.

Charitonetta albeola.
Rallus virginianus.
Rallus crepitans.
Philohela minor.
Colinus virginianus.
Quiscalus quiscula.
Poocætes gramineus.
Ammodramus s. savanna.
Ammodramus lecontei.
Ammodramus s. passerinus.
Spizella monticola.
Spizella pusilla,
Spizella socialis.
Junco hyemalis.
Passerina cyanea.
Melospiza fasciata.
Melospiza georgiana.
Passer domesticus.
Merula migratoria.
Mimus polyglottos.

DESCRIPTION.

Face encircled by a ruff of short compact feathers, as in the Owls.

Adult male.—Mostly of a uniform light bluish gray streaked with white; tail barred with six to eight bands, the one nearest the end being broader and darker; tips of the wings blackish.

Female and immature.—Dusky or rusty brown, more or less streaked on head and neck. The Marsh Hawk may be easily distinguished in any plumage by the large white patch on the rump.

Length: 19.50 to 24.00 inches (495 to 610^{mm}); extent, 40.00 to 45.00 inches (1016 to 1143^{mm}); wing, 12.90 to 16.00 inches (328 to 406^{mm}); tail, 8.80 to 10.50 inches (223 to 267^{mm}).

Table showing the results of examinations of 124 stomachs of the Marsh Hawk (Circus hudsonius).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Amityville, L. I., N. Y.	Oct. 17, 1885			Meadow mouse.	
Washington, D. C	Oct. 29, 1886			3 meadow mice.	
Bergen County, N. J	Nov. 26, 1885			Meadow mouse.	
Washington, D. C	Jan., 1887			do	
Sandy Spring, Md	Feb. 11, 1887		Junco		
Do	Oct. 2, 1887			Meadow mouse.	
Do	Oct. 14, 1887			do	
Do	Nov. 17, 1887			2 pine mice, 2 meadow mice.	
Do	Nov. 18, 1887		Tree sparrow	Pine mouse, 2 meadow mice.	
Do	Nov. 23, 1887			Meadow mouse.	
Travare, S. Dak	July 5, 1887			2 striped gophers.	
Pembina, N. Dak	July 30, 1887			Striped gopher.	
Do	do			Hair of striped gopher.	
Do	do			Striped gopher.	
Oakdale, N. Y	Oct. 4, 1887			Shrew	
Long Island City, N. Y.	Oct. 18, 1887			2 meadow mice.	
East Hartford, Conn	Sept. 17, 1887	Duck			
Cromwell, Conn	Oct. 5, 1886			Meadow mouse.	
Devils Lake, N. Dak	Aug. 11, 1887			Striped gopher.	
Do	Aug. 17, 1887			Meadow mouse.	
Sandy Spring, Md	Oct. 17, 1887			do	
Do	Feb. 13, 1887				Empty.
Sing Sing, N. Y	Oct. 1, 1881	Fowl			
Do	Sept. 17, 1882		Small bird		
Wethersfield, Conn	Sept. 17, 1887			Mice	
Do	Sept. 24, 1887		Small bird	do	
East Hartford, Conn	Nov. 12, 1886			3 meadow mice.	
Do	Oct. 17, 1886			2 meadow mice.	
Paint Rock, Tex	Dec. 7, 1886			Skunk	
Washington, D. C	Sept. 11, 1886	Fowl			
East Bradford, Pa	Aug. 22, 1878			Mice	
Westtown, Pa	Aug. 30, 1878		2 warblers	do	
Oxford, Pa	Nov. 5, 1879			do	
Brazile Creek, Nebr	Oct., 1869				Reptiles, 69 insects.
Do	do				15 locusts, 77 other insects.
Otoe County, Nebr	Sept., 1864				71 locusts, 10 other insects.
Sarpy County, Nebr	do				Lizard, 69 locusts.
Do	do			Gopher	51 locusts.
Douglas County, Nebr.	Oct., 1864				Lizards, 43 locusts.
Elmira, N. Y	May 7, 1886			4 mice	
Do	July 11, 1886			Mouse	Beetles.
Tyrone, N. Y	Aug. 17, 1886			Red squirrel	
Do	do			Field mice	
Barton, N. Y	Aug. 1, 1886	Woodcock.			Beetles.
Hale County, Ala	Mar. 17, 1888	Quail			
Washington, D. C	Mar 28, 1888			Meadow mouse.	
Kalamazoo, Mich	Nov. 28, 1886			Field mouse	
Do	Apr. 20, 1886			Mouse	
Hollis, N. H					Striped snake.
Concord, Mass					Do.
Montauk Pt., L.I., N.Y	Sept. 4, 1885				Frogs.
Do	Sept. 11, 1885		Robin	Moles (?)	
Hackensack, N. J	Sept. 24, 1885			Mice	
Schraalenburg, N. J	Nov. 26, 1885				Insects.
Jackson County, Mo	Dec. 22, 1883		Birds		
St. Helena Island, S. C.	Jan. 1, 1886		Clapper rail		
Raleigh, N. C	Oct. 29, 1886			Meadow mouse.	
Do	Oct. 13, 1888		3 small birds	3 mice	
Do	Oct. 22, 1888		1 sparrow		
Brookville, Ind	Nov. 22, 1885			2 meadow mice.	
Saratoga County, N. Y.	Sept. 1, 1877		Sparrow	Mouse	
Rensselaer County, N. Y	Aug. 9, 1879			Meadow mouse.	

Table showing the results of examinations of 124 stomachs of the Marsh Hawk (Circus hudsonius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Rensselaer County, N. Y	Sept. 10, 1883		4 sparrows	Meadow mouse	
Do	Aug. 26, 1885				Grasshoppers.
Do	Aug. 27, 1855		Thrush		
Do	Aug. 30, 1886			Squirrel	
Albany County, N. Y	Apr. 10, 1885			Mouse	
Do	May 30, 1884			Meadow mouse	
Do	Nov. 8, 1886		Small birds		
New York	Sept., 1886		Sparrow	Mice	
Oakdale, Suffolk County, N. Y.	Mar. 23, 1888			2 meadow mice	
Do	Apr. 24, 1888		Purple grackle		
Peterboro, N. Y	July 9, 1887		2 Savanna (?) sparrows.	1 meadow mouse	
Sandy Spring, Md	Oct. 29, 1888			3 meadow mice	
Cheyenne, Wyo	Aug. 21, 1888			Striped gopher	
Do	Aug. 22, 1888		Leconte's (?) sparrow.		
Do	Aug. 23, 1888				Grasshopper.
Fort Bridger, Wyo	Sept. 15, 1888				Frog.
Stratford, Conn	Sept. 21, 1888		Savanna sparrow	Meadow mouse	
Fairmount, W. Va	Sept. 14, 1888		Chipping sparrow.		
Oakdale, Suffolk County, N. Y.	Sept. 11, 1888		Chipping sparrow (?).		
Flatbush, Kings County, N. Y.	Sept. 29, 1888			8 meadow mice	
Long Island City, N. Y.	Sept. 22, 1888			2 meadow mice	
St. George, Utah	Jan. 4, 1889	Feathers of water fowl.		Rabbit hair	
Rayne, La	Feb. 24, 1889			do	
Sabine Station, La	Feb. 27, 1889				Snake.
Sandy Spring, Md	Aug. 28, 1889		Indigo bird		
Greensboro, Ala	Sept. 17, 1889		Mockingbird, field sparrow.		2 six-lined lizards, 1 grasshopper.
Stratford, Conn	Sept. 8, 1889		Song sparrow, swamp sparrow.		
Del Rio, Tex	Jan. 31, 1890			Cotton rats, rabbits.	
Circleville, Ohio	Dec. 7, 1881			Meadow mice	
Camp Verde, Ariz	Aug. 27, 1884	Poultry			
Do	Sept. 20, 1884		Small birds		
Mouth San Carlos River, Arizona.	Oct. 18, 1884			Small mammal	
Stones Lake, Arizona	Nov. 8, 1884				Empty.
Do	do				Do.
Do	do				Do.
Do	Sept. 11, 1884				Do.
Do	Dec. 5, 1885			Pocket gopher	
Camp Verde, Ariz	Apr. 16, 1887			Kangaroo rat, pocket gopher.	
Birch Creek, Idaho	Aug. 4, 1890		Feathers	Water shrew	
Do	do			Short-tailed spermophile.	
Clay County, S. Dak	Sept. 21, 1889				Empty.
Do	Oct. 1, 1889				Indeterminate matter.
Sandy Spring, Md	Oct. 6, 1890			Meadow mouse	
Lemhi Valley, Idaho	Sept. 6, 1890			Chipmunk	
Portland, Conn	Oct. 1, 1890			2 meadow mice	
Do	Oct. 14, 1890		2 swamp sparrows.	do	
Sandy Spring, Md	Dec. 2, 1890			3 meadow mice	
Morristown, N. J	Sept. 23, 1890			5 meadow mice	
Do	Sept. 26, 1890			1 meadow mouse	
Do	Oct. 3, 1890		Field sparrow, song sparrow.	3 meadow mice	
Union County, Ky	Oct. 11, 1890		Grasshopper sparrow.	1 meadow mouse.	
Amityville, N. Y	Mar. 8, 1890		Savanna sparrow.	2 meadow mice	
Sandy Spring, Md	Nov. 5, 1891			3 meadow mice, shrew.	
Buffalo, N. Y	Sept. 22, 1890			1 meadow mouse.	1 beetle.
Westbrook, Me	Apr. 12, 1890		2 vesper sparrows.		
Sandy Spring, Md	Dec. 10, 1891		English sparrow		

Table showing the results of examinations of 124 stomachs of the Marsh Hawk (Circus hudsonius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Harrison, S. Dak	Sept. 2, 1891				Empty.
Do	do				11 crickets, 1 grasshopper.
Do	Oct. 1, 1891			Meadow mouse.	
Portland, Conn	Sept. 28, 1891		Field sparrow		
Spiritwood, N. Dak	July 1, 1892				Empty.
Onaga, Kans	May 15, 1892		Virginia rail, young hawk.		

SUMMARY.—Of 124 stomachs examined, 7 contained poultry or game birds; 34, other birds; 57, mice; 22, other mammals; 7, reptiles; 2, frogs; 14, insects; 1 indeterminate matter, and 8 were empty.

SHARP-SHINNED HAWK.

Accipiter velox.

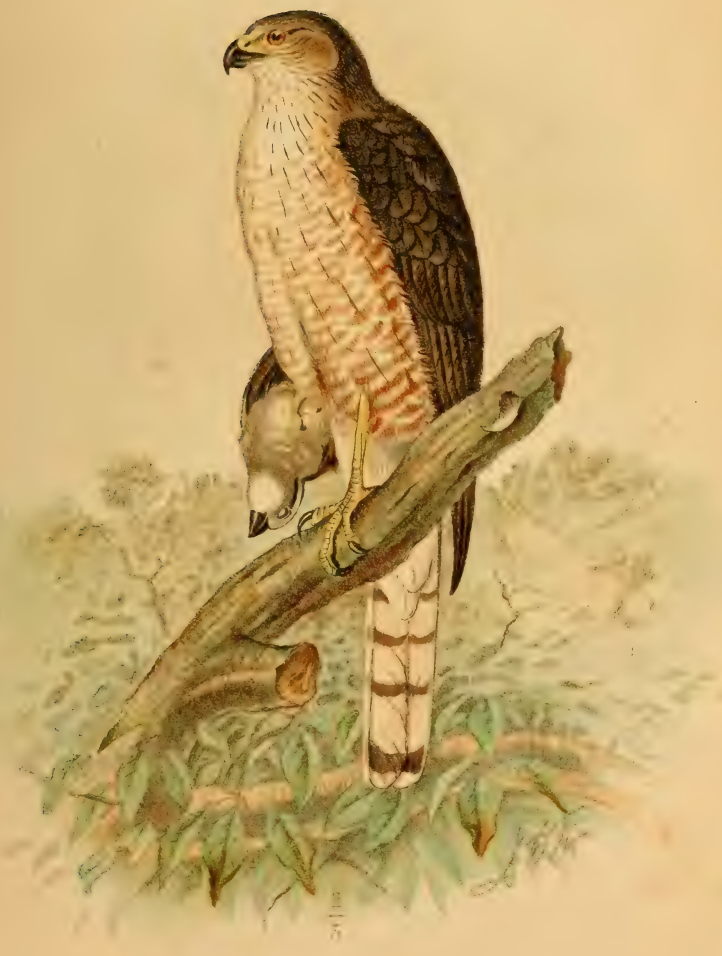
[Plate 4—Adult.]

The Sharp-shinned Hawk, one of the commonest and best known of our birds of prey, has an extensive distribution. It breeds in most, if not all, of the States and in the British Provinces, as far north as the Arctic circle. In winter it is found from about parallel 40° N., southward to Guatemala. In the latter part of September and the first of October it migrates through the Middle States in vast numbers. In southern New York the writer has seen several hundred during a day's tramp, the majority high in the air, though a few were flying low in search of food. The northward migration in spring, in the same locality, takes place during the latter part of March and first of April.

The food of this daring little Hawk is made up almost entirely of wild birds and young poultry, though occasionally it will take a few insects, mice, reptiles, or batrachians. Out of nineteen specimens examined by Dr. B. H. Warren, seventeen contained remains of poultry or wild birds. From this data and from an examination of our more extended table it will be seen how universal this class of food is. The following quotation from Audubon shows the variety of its bill of fare:

"The food of this hawk consists chiefly of birds of various sizes, from the smallest of our warblers to the Passenger Pigeon and young chicken, the latter appearing to afford a special temptation to it, as has been above related. I am also aware that it feeds occasionally on small reptiles and insects, and I shot the male represented in the plate, on wing, whilst it held in its claws the small Shrew also represented." (Ornith. Biography, vol. IV, p. 526.)

When a pair of Sharp-shinned Hawks find a farm where young chickens are easily obtained, they generally visit it until the supply gives out, or they themselves meet a tragic death. Nuttall speaks of a single bird which came every day to a farmhouse until it had carried away between twenty and thirty young chickens.



SHARP-SHINNED HAWK

Accipiter velox (Wils.

Mr. William Lloyd, writing from western Texas, says that he has seen it fly away with a pullet as big or bigger than itself, and so heavy that the legs dragged the ground. (Auk, vol. IV, 1887, p. 188.)

In times past when the wild pigeon was common, this little hawk caused great annoyance as well as loss to trappers. While standing in the bow-house scanning the horizon for an incoming flock, the man on watch would suddenly be startled by the violent fluttering of his 'stool pigeon' or of one of the 'fliers,' and upon looking around would find one of these little marauders fastened to the bird—a serious loss if he did not have a reserve pigeon, for hundreds might pass in easy hailing distance of his bow-house and still he would be powerless without the decoy. Many times has the writer stood near a bow-house and killed one of these Hawks which had been attracted to the spot from a considerable distance by the hovering stool pigeon. The following note from Mr. H. W. Henshaw shows that it is partial to this food in the West also:

"Upon one occasion, while watching a pair of doves feeding upon the ground, a female of this species made a daring and successful swoop upon one of them, passing within a few feet of the observer's head. As a further illustration of the bravery and hardihood with which this bird pursues its prey, it may be mentioned that one was observed in the town of Panquitch [Utah,] eagerly pursuing a common pigeon, apparently oblivious of the presence of spectators, who for some time vainly endeavored to drive it away." (Explor. West of the 100th Merid., Wheeler, vol. V, 1875, p. 417.)

Occasionally it will attack a bird many times its size, as the following quotation from Mr. Maynard demonstrates: "I once saw one strike down a fully-grown Night Heron that chanced to be abroad by day. * * * The slow-moving heron fell to the ground at once, but, fortunately for him, in falling he gave vent to one of those discordant squawks which only a bird of this species is capable of uttering, and which so astonished and frightened the hawk that it completely forgot to take advantage of its prostrate prey." (Birds of Eastern N. A., 1880, p. 304.)

Little can be said in favor of this Hawk although its daring, courage, and impudence are to be admired. On this and the two following species mainly rest the responsibility for the ill favor with which the other Hawks are regarded. A score of valuable species suffer because they belong to a class which includes two or three noxious kinds. However, like most villains, it has at least one redeeming quality, and that is its fondness for the English sparrow, our imported bird-nuisance. This Hawk is gradually learning that there is a never-failing supply of food for it in the larger towns and cities. The Sharp-shinned Hawk is not uncommon in Central Park, New York, all through the winter, where the writer has witnessed it chasing sparrows, as he has also in some of the larger parks in Washington, D. C. Numerous reports from various towns and villages show that the habit of visiting such places for the sparrow is becoming common.

The following species of birds were positively identified among the stomach contents:

Callipepla gambeli.
Zenaidura macroura.
Dryobates pubescens.
Colaptes cafer.
Colaptes auratus.
Chætura pelagica.
Molothrus ater.
Icterus spurius.
Quiscalus quiscula.
Carpodacus m. frontalis.
Spinus tristis.
Ammodramus s. savanna.
Ammodramus s. alaudinus.
Zonotrichia albicollis.
Spizella pusilla.
Spizella socialis.
Spizella monticola.
Junco hyemalis.
Melospiza fasciata.
Passerella iliaca.
Passer domesticus.
Pipilo aberti.
Vireo olivaceus.
Dendroica maculosa.
Dendroica virens.
Dendroica coronata.
Dendroica castanea.
Dendroica striata.
Dendroica vigorsii.
Seiurus aurocapillus.
Geothlypis trichas.
Sylvania pusilla.
Sylvania p. pileolata.
Sylvania canadensis.
Mimus polyglottos.
Galeoscoptes carolinensis.
Harporhynchus crissalis.
Campylorhynchus brunneicapillus.
Thryothorus ludovicianus.
Sitta canadensis.
Parus atricapillus.
Regulus calendula.
Turdus aliciæ.
Turdus aonalaschkæ pallasii.
Merula migratoria.
Sialia sialis.

This little Hawk is one of the latest to commence nesting, laying its eggs when most of the other species have half-grown young. North of parallel 40° full complements of eggs are not found until the latter part of May, and early in June sets are often taken which are only slightly incubated. The nest, which is situated usually in a dense hemlock or other conifer, though occasionally in a deciduous tree, is rarely at any considerable height from the ground, 20 feet being a fair average. The bird is said to build sometimes in the crevices of cliffs or hollows of trees, but these sites must be considered exceptional. The nest is a large structure in proportion to the size of the bird, and is made of dry sticks more or less compactly placed together, with or without a sparse lining of soft inner bark or green leaves. It does not always construct its own nest, for it sometimes remodels the old nest of the crow, magpie, or even squirrel. The eggs are four or five in number, and are usually deposited on alternate days, though occasionally only on every third day. Among the *Raptores* the nest of this species is one of the easiest to find, as the parents invariably commence scolding as soon as an intruder enters their domain, even when the nest is being constructed.

The flight of the Sharp-shinned Hawk is swift, but irregular, often protracted, and is identical in character with that of the two following species. At times it passes rapidly along the fence rows or darts in and out among the brier patches in search of small birds; at other times it may be seen passing over the country high in the air or soaring in wide circles over some particular spot.

DESCRIPTION.

Tail more than two-thirds as long as wing, its tip even or slightly notched; wing not more than 8.80 inches (223^{mm}).

Adult.—Uniform bluish gray above, top of head darker, tail crossed by several blackish bands; below, white, with breast and sides barred dusky or rufous.

Immature.—Above, dusky more or less spotted with lighter, the feathers bordered with rusty; below, whitish, streaked with brown or dusky.

Length: 10 to 14 inches (254 to 355^{mm}); extent, 21 to 25 inches (533 to 635^{mm}); wing, 6 to 8.80 inches (152 to 223^{mm}); tail, 5.80 to 8.20 inches (147 to 208^{mm}).

Table showing the results of examinations of 159 stomachs of the Sharp-shinned Hawk (Accipiter velox).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sing Sing, N. Y	Sept. 10, 1885				Empty.
Do	Sept. 17, 1885		2 warblers		
Do	do		Warbler		
Do	Sept. 24, 1885		Field sparrow		
Southold, N. Y	Nov. 20, 1885		Chipping sparrow, purple grackle.		
Alfred Centre, N. Y	Sept. 17, 1885		Warbler		
Taunton, Mass	Oct. 6, 1885		Goldfinch		
Do	Nov. 21, 1885		2 small birds		
Sing Sing, N. Y	Sept. 25, 1886		Junco and kinglet.		
Peterboro, N. Y	July 22, 1886		Small bird		
Portland, Conn	Mar. 27, 1886		Robin		
Maplewood, N. J	May 25, 1886		Oriole, swift		
Montgomery Co., Pa	Sept. 18, 1886		Small bird		
Woodstock, Conn	May 2, 1887		do		
Long Island City, N.Y.	Sept. 21, 1887		English sparrow, warbler.		
Greensboro, Ala	Nov. 11, 1887		White-throated sparrow.		
Middletown, Conn	Jan. 19, 1887		2 English sparrows.		
Portland, Conn	Apr. 2, 1887		Robin		
Do	Oct. 20, 1887		Field sparrow		
Fort Buford, N. Dak	Sept. 9, 1887		Thrush		
Washington, D. C	Dec. 31, 1887		White-throated sparrow.		
Sing Sing, N. Y	Apr. 7, 1880		Robin		
East Hartford, Conn	Oct. 17, 1886		Warbler		
Easthampton, Mass	May 9, 1874		Junco		
South Windsor, Conn	Nov. 4, 1887				Do.
Portland, Conn	Nov. 8, 1886				Do.
Do	Feb. 4, 1881		Goldfinch, chickadee.		
Fort Buford, N. Dak	Sept., 1887		Dove		
Sandy Spring, Md	Apr. 23, 1887				Do.
Do	do				Do.
Do	do		Bluebird		
Do	Sept. 20, 1887				Do.
Do	Sept. 26, 1887		Small bird		
Do	Oct. 2, 1887				Do.
Do	Nov. 5, 1887				Do.
Do	Nov. 22, 1887				Do.
Chester County, Pa	Nov. 26, 1886		Fox sparrow, song sparrow.		
Do	Sept. 20, 1884		Field sparrow		Beetles.

Table showing the results of examinations of 159 stomachs of the Sharp-shinned Hawk (Accipiter velox)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Sept. 28, 1880	Quail			
Do	Sept. 10, 1874		English sparrow	Mice	
Do	Oct., 1875		Small bird	do	
Do	Feb. 16, 1880			do	
Do	May 19, 1881	Poultry			Insects.
Elmira, N. Y	Mar. 4, 1886		English sparrow	Mouse	
Do	Apr. 18, 1886		Small bird		
Big Flats, N. Y	Sept. 23, 1886		English sparrow		
Do	do				Indeterminate.
Gainesville, Fla	Dec. 22, 1887				Empty.
Sandy Spring, Md	May 3, 1888				Do.
East Hartford, Conn	Apr. 29, 1888	Chicken.	Chipping sparrow.		
Do	May 5, 1888		Robin	White-footed mouse.	
Do	Aug. 29, 1887		Song sparrow		
Do	Oct. 1, 1887		Yellow-rumped (?) warbler.		
Sandy Spring, Md	Sept. 13, 1888				Do.
Do	do				Do.
Do	Sept. 26, 1888		Warbler		
Carter Station, Wyo	Sept. 15, 1888		Sparrow		
Gallatin Station, Mont	Sept. 9, 1888		do		
Sandy Spring, Md	Nov. 10, 1888				Do.
Buckhannon, W. Va	Aug. 3, 1888		Song sparrow		
Do	Aug. 13, 1888		Savanna sparrow.		
Fairmont, W. Va	Sept. 18, 1888		Goldfinch		
Rockaway Beach, L.I., N. Y.	Sept. 26, 1888		English sparrow		
Ogden, Utah	Oct. 11, 1888		House finch		
Cobourg, Canada	Aug. 30, 1888		Red-billed nuthatch.		
Sandy Spring, Md	May 1, 1889		Song (?) sparrow		
San Francisco Mountain, Ariz.	Aug. 13, 1889				Do.
Do	Aug. 27, 1889		Wilson's blackcap.		
Wellesley Hills, Mass	Sept. 27, 1889		2 blackpoll (?) warblers.		
Sandy Spring, Md	Oct. 14, 1889		Feathers		
Beaver, Pa	Aug. 1, 1889		Downy woodpecker.		
Schroon Lake, N. Y	Aug. 10, 1882		Small bird		
St. Helena Island, S. C	Dec. 26, 1884		Savanna sparrow		
Do	do				Grasshopper.
Bayou des Allemands, La.	Dec. 18, 1888			Mouse	Dragon flies.
Raleigh, N. C	Nov. 18, 1885				Empty.
Do	Dec. 2, 1885				Do.
Do	Oct. 7, 1886				Do.
Do	Dec. 10. 1886		2 sparrows		
Do	Mar. 21, 1888				Do.
Do	Aug. 17, 1888				Do.
Do	Oct. 3, 1888		1 sparrow		
Do	Nov. 12, 1888				Do.
Do	Dec. 5, 1888		Carolina wren		
Brookville, Ind	Dec. 7, 1886				Do.
Do	Dec. 19, 1886				Do.
Albany County, N. Y	Jan. 5, 1882		Small bird		
Rensselaer County, N. Y.	July 24, 1884		Feathers		
Do	Sept. 15, 1886				Do.
Do	Oct. 11, 1886				Do.
Do	Aug. 7, 1887				Do.
Do	do				Do.
Do	do		Sparrow		
Do	May 20, 1888		Small bird		
Troy, N. Y	Sept. 11, 1885				Do.
Do	Jan. 30, 1887		Feathers		
Rensselaer County, N. Y.	Sept. 4, 1888		Flicker and small bird.		
Do	Sept. 30, 1888		Sparrow		
Do	Apr. 30, 1889		2 sparrows		
Troy, N. Y	Dec. 28, 1888		2 chickadees		
Gaylordsville, Conn	Apr. 15, 1889				Do.
Hale County, Ala	Nov. 9, 1889		Cowbird		
Sandy Spring, Md	Jan. 11, 1890				Do.
Do	Feb. 22, 1890		Fox sparrow, other sparrow.		

Table showing the results of examinations of 159 stomachs of the Sharp-shinned Hawk (Accipiter velox)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Long Island City, N. Y	Sept. 24, 1889		Snowbird		
Do	Oct. 5, 1889		Song sparrow		
Do	May 6, 1889		Robin		
Raleigh, N. C	Nov. 12, 1889				Empty.
Do	Dec. 24, 1889				Do.
Sandy Spring, Md	May 1, 1890		Yellowbird		
San Francisco Mountain, Ariz.	Aug. 19, 1889		Warbler		
Highland Falls, N. Y	Oct. 11, 1877				Do.
Garrisons, Putnam County, N. Y.	Apr. 28, 1877		Field sparrow		
Barnegat, N. J	Nov. 5, 1878		Field sparrow, other birds.		
Camp Verde, Ariz	May 1, 1884		Mocking bird		
Mogollon Mountains, Ariz.	Oct. 3, 1884				Do.
Globe City, Ariz	Oct. 20, 1884		Cactus wren		
Ash Fork, Ariz	Nov. 6, 1884				Do.
Camp Verde, Ariz	Dec. 15, 1884				Do.
Yavapai County, Ariz	Jan. 15, 1885				Do.
Camp Verde, Ariz	Oct. 10, 1885	Gambel's quail.			
Do	do	do			
Do	Dec. 23, 1885		Small birds		
Do	Jan. 5, 1886	Gambel's quail.			
Do	Apr. 4, 1886				Do.
Do	Apr. 8, 1886		Crissal thrasher		
Do	Nov. 1, 1886		Mourning dove		
Do	Dec. 30, 1886				Do.
Do	Sept. 13, 1887				Do.
Do	Jan. 7, 1888		Abert's towhee, other birds.		
Do	Feb. 3, 1888				Do.
Do	Feb. 10, 1888				Do.
Payson, Ariz	Feb. 18, 1888		Red-shafted flicker.		
Morristown, N. J	May 2, 1890				Do.
Madisonville, La	Aug. 7, 1890		Pine-creeping warbler.		Grasshoppers.
Sandy Spring, Md	Sept. 19, 1890				Empty.
Do	Sept. 21, 1890				Do.
Do	do		Warbler		
Do	do		Vireo, warbler		
Do	Sept. 23, 1890		Catbird		
Do	Dec. 5, 1890				Do.
Salmon River Mountains, Idaho.	Aug. 28, 1890		Black-capped warbler.		
Portland, Conn	Oct. 1, 1890		Field sparrow		
Do	Oct. 2, 1890		Song sparrow		
Raleigh, N.C	Oct. 1884		Flicker		
Sandy Spring, Md	Dec. 9, 1890		Tree sparrow		
Dunn-Loring, Va	Dec. 10, 1890		Hermit thrush		
Wayne County, Mich	Oct. 5, 1890		Robin		
Eliot, York County, Me	Aug. 12, 1890		Warbler		
Sandy Spring, Md	Nov. 26, 1891				Do.
Portland, Conn	Oct. 10, 1891				Do.
Nashville, N. Y	May 13, 1892		Oven bird, 1 other small bird.		
Portland, Conn	May 9, 1892				Do.
Sandy Spring, Md	1892.		2 sparrows		
Do	1892.		Goldfinch and one other small bird.		
Shrewsbury, Mass	Aug. 10, 1891				Do.
Do	do		Small bird		
Do	do				Do.
Do	do				Do.

SUMMARY.—Of 159 stomachs examined, 6 contained poultry or game birds; 99, other birds; 6, mice; 5, insects; and 52 were empty.

COOPER'S HAWK.

Accipiter cooperi.

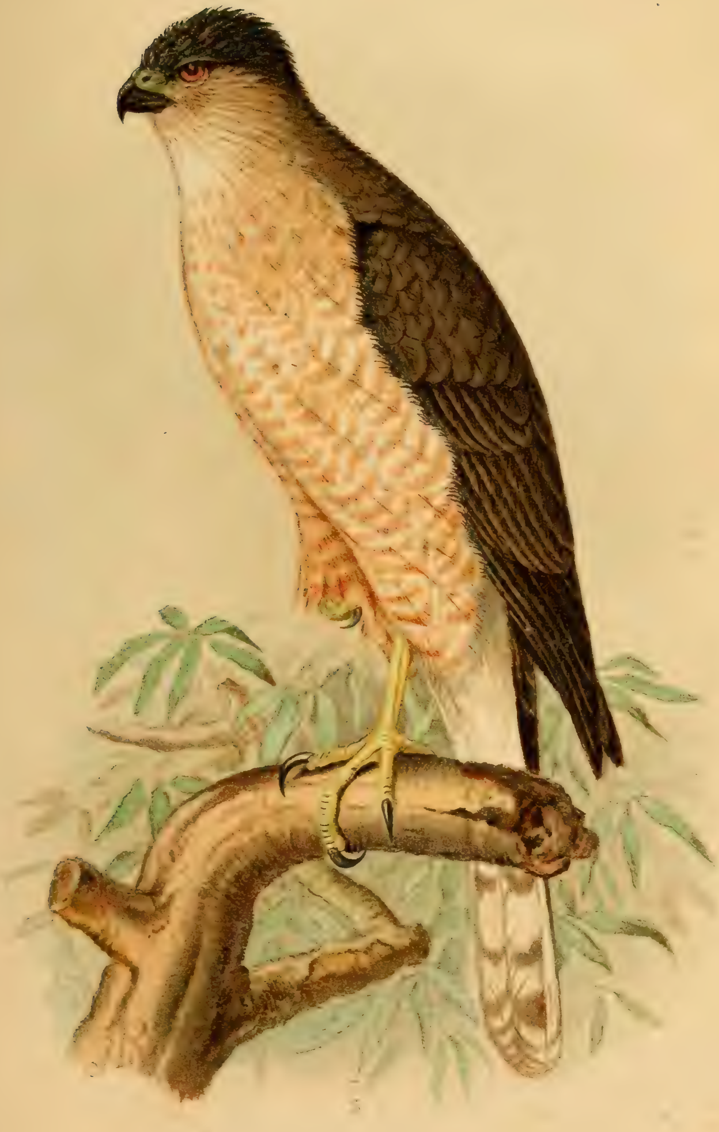
[Plate 5—Adult.]

Cooper's Hawk, which resembles the Sharp-shinned Hawk closely in everything except size, is less northern in its distribution. It inhabits the whole of North America from the southern portion of the British provinces throughout the United States and the greater part of Mexico. It winters regularly from about latitude 40° southward, though occasionally it is seen at this time of the year in southern Canada. It breeds throughout its range, and is common everywhere in suitable localities.

The food of this Hawk, like that of its smaller congener, consists almost entirely of wild birds and poultry, though from its superior size and strength it is able to cope successfully with much larger birds, and hence is much more to be dreaded. Besides birds, it occasionally captures small mammals, reptiles, batrachians, and insects. Mr. Calvin Rawson saw one of these Hawks make a bold dash at a muskrat, but it was unsuccessful in the capture. (Ornith. and Oologist, vol., VI, 1881, p. 74.) From the following quotation by Mr. Charles F. Morrison, it would appear that in Colorado it feeds more extensively on insects than in most parts of the country: "It preys upon grouse, hares, and reptiles. Its fondness for the ranchman's poultry is very nearly paid for by the insects it eats; both this and the preceding adding grasshoppers and bugs to their bill of fare." (Ornith. and Oologist, vol. XIV, 1889, p. 7.)

Mr. W. E. Clyde Todd, of Beaver, Pa., furnishes the following note on this Hawk: "The crops and stomachs of five young, still in the down, which were taken from a nest in the top of a tulip tree on July 8, 1891, contained among other things not identified, the remains of a brown thrasher and light-colored flesh, evidently that of a young ruffed grouse, of which there was a covey in the same woods."

Cooper's Hawk is very destructive to domesticated pigeons, and when it finds a cote which is easy of approach, is very troublesome. Dr. William C. Avery, of Greensboro, Ala., informs us that during one year he killed and wounded at least a dozen of these Hawks before the inroads among his doves ceased. Among the smaller birds, this Hawk is very fond of meadowlarks, robins, and flickers. The writer on several occasions has secured specimens in hot pursuit of the last named bird, which gave expression to their alarm by loud and continued cries. Poultry of all kinds form a very large part of its food. Dr. Warren states that a pair of these Hawks destroyed some fifty chickens from one farm, twelve of which were taken in a single day. The writer knew



COOPER'S HAWK.

[illegible]

of one of these Hawks which made daily visits to a coop containing a late brood of Wyandotte chickens, and undoubtedly would have taken all but for its timely death by the gun. The following quotations show how extensively it feeds on game and domesticated birds. Nuttall says:

"His food appears principally to be birds of various kinds; from the sparrow to the Ruffed Grouse, all contribute to his rapacious appetite. * * * His depredations among the domestic fowls are very destructive." (Land Birds, 1832, p. 90.)

Dr. Coues says: "It attacks and destroys hares, grouse, teal, and even the young of larger ducks, * * * besides capturing the usual variety of smaller birds and quadrupeds. It occasionally seizes upon reptiles or picks up insects." (Birds of Northwest, p. 338.)

Mr. H. Nehrling says: "This very common and impudent robber is the most destructive of the Raptores to the barnyard fowls; in a short time all the young chickens, turkeys, and ducks are killed by it." (Bull. Nutt. Ornith. Club, vol. VII, 1882, p. 174.)

Mr. Thomas McIlwraith says: "This is one of the chicken hawks, and it well deserves the name, from the havoc it makes among the poultry." (Birds of Ontario, p. 137.)

Mr. Henshaw informs me that the Cooper's Hawk is very partial to quail's flesh in California and the southern territories, and that it undoubtedly secures many victims. He once saw a young female dart into a bevy of Gambel's quail and seize one with the utmost ease, though the birds were flying at full speed. In an instant the flock scattered in every direction and sought refuge in the bushes, from which it proved next to impossible to dislodge them. They had recognized their enemy and evidently knew that their only chance for safety lay in close hiding.

The following examination, made by Dr. B. H. Warren, gives a very good summary of this Hawk's food: "Of the thirty-four birds which I have examined, sixteen showed the food taken to have been chickens; ten revealed small birds—sparrows, warblers, and meadow-larks; two, quail; one, bull-frogs; three, mice and insects; two, hair and other remains of small quadrupeds." (Birds of Pennsylvania, 1888, p. 80.)

This species is preëminently a 'Chicken Hawk,' as may be seen from the foregoing citations. Its devastations in this direction are much greater than those of all the other hawks and owls together, with the possible exception of the Sharp-shinned Hawk, which attacks much smaller chickens.

Like the Sharp-shinned Hawk this species has learned that the English sparrow is not only an acceptable article of food but is also a readily accessible one. Consequently of late years it has been much more common during the winter months in the larger parks of cities, where it spreads terror among the sparrows.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Tamias quadrivittatus.
Tamias striatus.
Sigmodon hispidus.
Spermophilus beecheyi.
Lepus sylvaticus.

BIRDS.

Bonasa umbellus.
Colinus virginianus.
Callipepla gambeli.
Zenaidura macroura.
Colaptes auratus.
Sturnella magna neglecta.
Quiscalus quiscula.
Spinus tristis.
Ammodramus s. savanna.
Zonotrichia l. intermedia.
Spizella monticola.
Spizella pusilla.
Junco hyemalis.
Melospiza fasciata.
Passer domesticus.
Pipilo erythrophthalmus.
Helminthophila celata lutescens.
Sitta c. aculeata.
Turdus u. swainsoni.
Turdus a. pallasii.
Merula migratoria.

An instance of this Hawk attacking a person was experienced by Mr. C. D. Walcott, in Lewis County, N. Y., August 31, 1886. Mr. Walcott was in a secluded glen busily engaged in collecting fossils, when an individual alighted near by. Almost instantly the bird pitched at him and was repelled with a geological hammer. Undaunted it made a second and more vigorous attack on the paleontologist, which was met in turn by more decided action on his part, and resulted in the death of the Hawk from a sweeping blow of the hammer.

The nest is situated indifferently in the tops of the lofty trees or in the second growth within 10 or 15 feet of the ground; most authors state that evergreen trees are principally chosen for the site, though the writer does not remember of ever having found one in this situation. The nest resembles that of the crow somewhat in structure and size, but lacks the finish and compact lining found in that of the latter bird. It is often bulky, the sticks composing it are quite large, and the lining usually is nothing more than the rough outer bark of the spruce, oak, or hickory. Like the preceding species, it frequently remodels the old nests of other Hawks, crows, or even those of the squirrels. The male assists in building the new nest or repairing the old one. When the nest is approached or even when the grove containing it is entered, the Hawks will often fly about and scold at the intruder until he leaves. The eggs, which are usually four or five in number, are deposited during the latter part of April to the middle of May, according to latitude. Even in Texas fresh eggs are found about the first of May, though as an exceptional case Mr. Nehrling found young in April.

The flight of this species is very rapid, irregular, and usually is carried on at no great height from the ground, in all these particulars closely resembling that of the Sharp-shinned Hawk. In the 'Birds of the Northwest' Dr. Coues mentions three birds of this species which he saw at a ranch in Arizona. They were perfectly tame, and at the time of his visit were allowed full liberty to go where they pleased, and always returned to their owner at the sound of his whistle.

DESCRIPTION.

Tail more than two-thirds as long as wing, its tip decidedly rounded; wing more than 8.80 inches (223$^{\mathrm{mm}}$) and less than 12 inches (305$^{\mathrm{mm}}$).

Adult.—Uniform bluish-gray above, top of head blackish; tail crossed by several blackish bands; below white, with breast and sides barred with dusky or rufous.

Immature.—Dusky above, more or less spotted with lighter, feathers with rusty edges; below whitish, streaked with brown or dusky.

Length: 14 to 20 inches (355 to 508$^{\mathrm{mm}}$); extent, 27 to 32 inches (686 to 812$^{\mathrm{mm}}$); wing, 8.85 to 11 inches (223 to 280$^{\mathrm{mm}}$); tail, 7.80 to 10.50 inches (197 to 267$^{\mathrm{mm}}$).

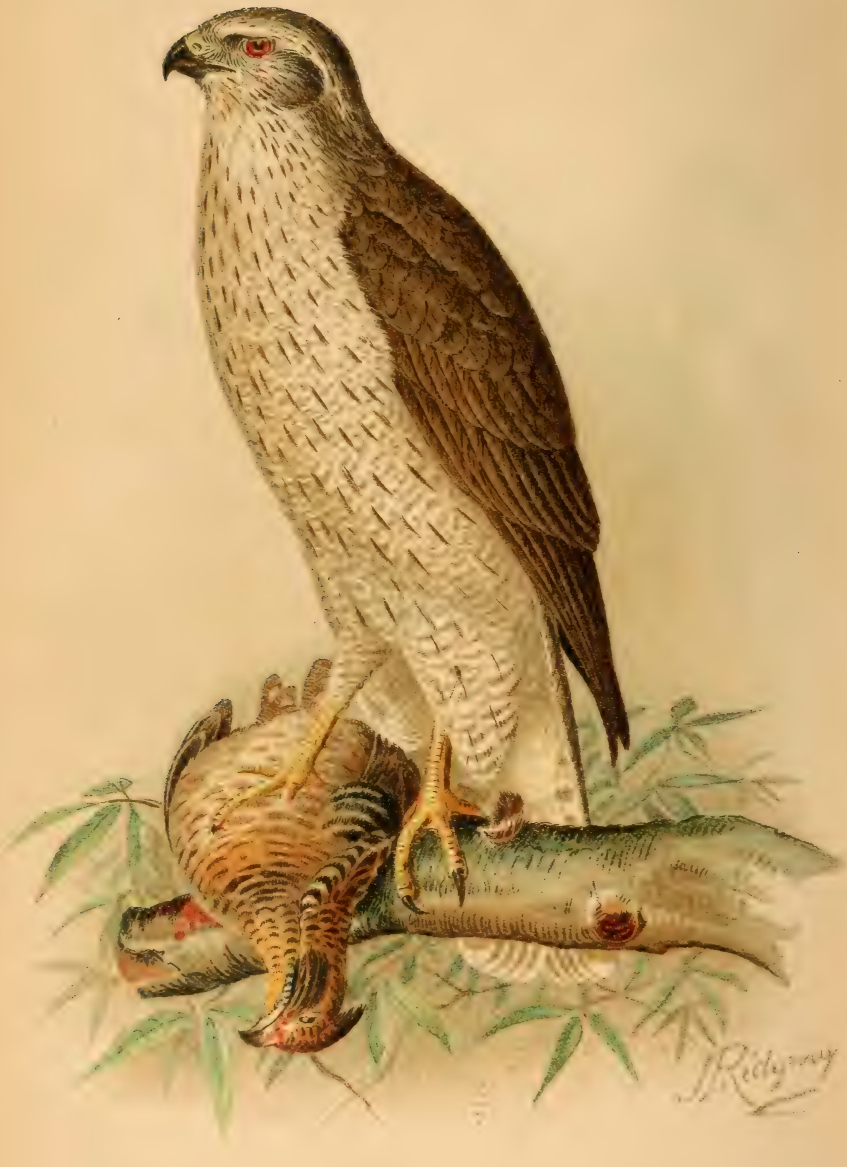
This species closely resembles the Sharp-shinned Hawk, but may be distinguished by its larger size and the fact that the end of the tail is rounded instead of straight or slightly notched.

Table showing the results of examinations of 133 stomachs of Cooper's Hawk (Accipiter cooperi).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Taunton, Mass	Sept. 21, 1885		Chewink		
Do	Oct. 6, 1885		do		
River Vale, N. J	Sept. 18, 1886				1 grasshopper.
Washington, D. C	Nov. 28, 1886		Tree sparrow		
Sing Sing, N. Y	Sept. 7, 1880	Chicken			
Do	Nov. 18, 1884	do			
Greensboro, Ala	Oct. 28, 1887				Empty.
Do	Mar. 6, 1887	Pigeon			
Do	July —, 1887	do			
Do	Aug. 4, 1887	do			
Do	Aug. 30, 1887				Do.
Do	Sept. 13, 1887	Pigeon			Sand lizar
Do	Sept. 27, 1887				Empty.
Wethersfield, Conn	Sept. 9, 1887				Do.
East Hartford, Conn	July 31, 1887				Do.
Sandy Spring, Md	Jan. 14, 1887	Quail			
Do	Mar. 1, 1887		Song sparrow		
Do	Apr. 22, 1887	Chicken			
Do	May 7, 1887	do			
Do	May 25, 1887				Do.
Do	Sept. 14, 1887				Do.
Do	Sept. 21, 1887				Do.
Do	Nov. 24, 1887		Purple grackle		
Do	Dec. 26, 1887	Quail			
Do	Jan. 30, 1888	do			
Do	Feb. 11, 1888		Junco, savanna sparrow.		
Chester County, Pa	Nov. 13, 1886		Junco		
Do	Nov. 27, 1886		Small bird		
Do	Dec. 17, 1886	Chicken			
Do	Jan. 10, 1887		Small bird		
Do	Jan. 17, 1887				Do.
Do	Feb. 1, 1887		Small bird		
Do	Feb. 20, 1887	Chicken			
Do	Mar. 3, 1887		Meadow lark		
Do	Dec. 6, 1878		Small bird		
New Castle Co., Del	Nov. 1, 1878	Poultry			
Williston, Pa	Dec. 6, 1878		Small bird		
East Bradford, Pa	May 25, 1875				Frog.
East Goshen, Pa	May 20, 1877			Mice	Beetles.
West Chester, Pa	Aug. 25, 1876		English sparrow		
Pocopson, Pa	Nov. 12, 1879	Poultry			
West Chester, Pa	Sept. 10, 1880		English sparrow		
Sandy Spring, Md	Mar. 17, 1888		Sparrow		
Gainesville, Fla	Dec. 22, 1887				Empty.
Sandy Spring, Md	Mar. 24, 1888		Song sparrow		
Do	Apr. 2, 1888				Do.
Do	Apr. 26, 1888	2 young chickens	1 flicker		
East Hartford, Conn	Sept. 19, 1887				Do.

Table showing the results of examinations of 133 stomachs of Cooper's Hawk (Accipiter cooperi)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	June 28, 1888		1 flicker		
Do	do		do		
Do	do				Empty.
Custer, S. Dak	July 9, 1888		Nuthatch		
Bridgeport, Conn	Oct. 8, 1888		Bird		
Greensboro, Ala	Aug. 16, 1888				Do.
Sandy Spring, Md	Dec. 4, 1888				Do.
Do	Feb. 28, 1889			Mouse	
San Francisco Mountain, Ariz.	Aug. 4, 1889			Rocky Mountain chipmunk.	
Greensboro, Ala	Sept. 30, 1889				Do.
Sandy Spring, Md	Oct. 14, 1889			Chipmunk	
Do	Dec. 1, 1889		Feathers		
Do	Dec. 5, 1889		Gold finch		
Do	Dec. 10, 1889				Do.
Do	Dec. 12, 1889		English sparrow		
Kalamazoo, Mich	May 6, 1888	Small chicken.			
Do	Sept. 12, 1886	Chicken			
Good Ground, Long Island, N. Y.	Jan. 13, 1882	Pigeon			
Cincinnati, Ohio	May 11, 1885		Young bird		
Do	May 24, 1885		Hermit thrush		
Brookville, Ind	Jan. 2, 1885		Feathers	Rabbit	
Do	Oct. 7, 1887			Mouse	
Fairfield, Ind	Feb. 15, 1887		Feathers		
Brookville, Ind	Nov. 24, 1888				Do.
Raleigh, N. C	Dec. 7, 1886				Do.
Do	Jan. 24, 1887		1 sparrow		
Do	May 4, 1887		1 field sparrow		
Do	Aug. 16, 1887				1 six-lined lizard.
Do	Oct. 1, 1887				Empty.
Do	Feb. 12, 1888				Do.
Do	Mar. 28, 1888	Chicken	Dove		
Do	Sept. 20, 1888		Feathers		
Albany County, N. Y	Aug. 14, 1878		Small bird		
Do	Sept. 15, 1884		Sparrow		
Do	Jan. 30, 1887				Do.
Rensselaer County, N. Y	Nov. 20, 1879				Do.
Do	Nov. 8, 1887			Red squirrel	
Do	Sept. 6, 1888		Robin	Chipmunk	
Do	Sept. 14, 1888	Chicken	Small bird		
Stratford, Conn	Oct. 23, 1889		Song sparrow		
Sandy Spring, Md	Dec. 27, 1886				Do.
Do	Feb. 20, 1890		Snowbird		
Greensboro, Ala	Feb. 12, 1890	Quail			
Sandy Spring, Md	Mar. 8, 1890				Do.
Greensboro, Ala	Mar. 7, 1890		Small bird	Cotton rat	
Bellefontaine, Ohio	June 1, 1889	Young chicken			
Marfa, Tex	Jan. 22, 1890		Feathers		
Highland Falls, N. Y	May 10, 1876	Ruffed grouse.			
Camp Verde, Ariz	May 2, 1884				Do.
Do	Aug. 20, 1884	Poultry			
Do	Sept. 15, 1884	Gambels quail.			
Do	Sept. 16, 1884				Do.
Do	Sept. 23, 1884				Do.
Pine Creek, Tonto Basin, Ariz.	Oct. 24, 1884				Do.
Yavapai County, Ariz	June 25, 1885	Gambels quail.			
Verde River, Ariz	Aug. 6, 1885				Do.
Camp Verde, Ariz	Sept. 9, 1885	Gambels quail.			
Do	May 27, 1886				Do.
Do	Aug. 15, 1886				Do.
Do	Sept. 6, 1886				Do.
Yavapai County, Ariz	Apr. 1, 1887		Intermediate sparrow.		
Camp Verde, Ariz	May 13, 1887				Lizards.
Do	Aug. 17, 1887		Mourning dove		
Do	Nov. 1, 1887				Empty.
Do	Feb. 10, 1888				Do.
Touchet Station, Wash.	Sept. —, 1890		Orange-crowned warbler.		
Sandy Spring, Md	Nov. 19, 1890	Poultry			
Morristown, N. J	Sept. 17, 1890		Song sparrow		



AMERICAN GOSHAWK

Table showing the results of examinations of 133 stomachs of Cooper's Hawk (Accipiter cooperi)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Morristown, N. J	Sept. 19, 1890		Song sparrow		
Eubank, Ky	Apr. 15, 1889		White feathers	Gray squirrel	
Union County, Ky	Oct. 11, 1890		Thrush		
Do	Nov. 1, 1890	Chicken			
Wayne County, Mich	May 4, 1890		Meadowlark		
Lancaster County, Pa	Nov. 16, 1891				Empty.
Sandy Spring, Md	Mar. 17, 1892		Song sparrow		
Portland, Conn	Mar. 17, 1891				Do.
Do	Oct. 1, 1891		Small bird		
Do	Oct. 12, 1891	Chicken			
Do	May 1, 1892				Do.
Sandy Spring, Md	Jan. 11, 1891				Do.
Do	do	Quail, chicken			
Do	———, 1892	Chicken			
Three Rivers, Cal	July 28, 1891			California ground squirrel	
Clinton, Me	May 30, 1892		Song sparrow		

SUMMARY.—Of 133 stomachs examined, 34 contained poultry or game birds; 52, other birds; 11, mammals; 1, frog; 3, lizards; 2, insects; and 39 were empty.

GOSHAWK.

Accipiter atricapillus.

[Plate 6—Adult.]

The Goshawk is more northerly in its distribution than the two preceding species of the genus and is separable into two geographical races. The typical form (*atricapillus*) inhabits northern and eastern North America west to the Rocky Mountains-and eastern Washington and Oregon; breeding in the east chiefly north of the United States and in the Rocky Mountains as far south as Colorado. The west coast race (*striatulus*) inhabits the Pacific coast north to Sitka, and breeds as far south, in the Sierra Nevada, as latitude 30°. The writer has seen a specimen from Labrador which to all appearances was identical with those from the west coast. In autumn and winter it wanders south casually to Virginia, Kentucky, Missouri, Kansas, and New Mexico. As above stated, but a small proportion of the species remain in the United States to breed, though a few are found in all the northern tier of States during that period. It is a common resident throughout the wooded portions of the British provinces, and in summer occurs commonly from Hudson Bay to the Arctic Circle and through the intervening country to northern Alaska.

The Goshawk, like the two preceding species of the genus, feeds largely on the flesh of birds, and to a less extent on mammals. Poultry, ducks, grouse, and many of the smaller birds, together with hares, squirrels, and other rodents make up its fare. Fortunately, in most farming districts, at least in the United States, it is comparatively rare except during the fall and winter months, otherwise its depredations among the poultry would be a very serious matter. Its large size and greater strength enable it to carry off heavier quarry than Cooper's Hawk, and consequently its powers for mischief are more to be dreaded by the poultrymen. Mr. L. M. Turner states that in Alaska the lemming forms a consideral part of its food.

This species is one of the most daring of all the Hawks, and while in pursuit of its prey is apparently less concerned by the presence of man than any other. It will dart down unexpectedly at the very feet of the farmer and carry off a fowl. The following from the pen of the late Dr. William Wood gives evidence of its boldness:

"The goshawk is the most daring and venturesome of any of our diurnal birds of prey. A farmer who resides a few miles from my office, wishing to perpetuate the old New England custom of having a chicken pie for Thanksgiving dinner, caught some fowls, took them to a log, severed the neck of one, and threw it down beside him. In an instant a goshawk seized the struggling fowl, and, flying off some ten rods, alighted and commenced devouring his prey. The boldness of the attack so astonished the farmer that he looked on with blank amazement. Recovering from his surprise, he hastened into the house and brought out his gun, which secured him both the hawk and the fowl. Another instance of still greater daring occurred near East Windsor Hill, Connectcut. A goshawk flew after a fowl near a dwelling house; the door being open, the hen flew inside; the hawk followed, and seized her in the room occupied by an old gentleman and his daughter. The old man hastened to the rescue, and struck the hawk with a cane before it released its grasp. The daughter caught the hawk as it attempted to fly out of the door, and killed it." (Amer. Nat., vol. x, 1876, p. 134).

Capt. Charles E. Bendire informed the writer that at Fort Klamath, Oregon, he once shot at a Goshawk and slightly wounded it with fine shot, and in the course of a few minutes it returned and attacked a chicken. Numerous cases are on record where it has flown through windows to attack canaries or other cage birds.

In the general character of its flight, as well as the mode of hunting and capturing its prey, it closely resembles Cooper's Hawk, though it frequents the thick woods rather more than the latter bird. In the fall this Hawk is common along the smaller water courses where it is very destructive to wild ducks and other water fowl, and is able to strike down a bird as large as a full-grown mallard. If its prey is a bird of this size it rarely eats more than the flesh from the breast, leaving the rest of the carcass untouched. Scorning to feed upon carrion, another victim is secured when hunger returns.

Of the upland game birds the ptarmigan in the North and the ruffed grouse in the middle districts suffer severely from the attacks of this powerful Hawk. Dr. William H. Dall, who found it common in the valley of the Yukon River, states that it feeds largely on the white ptarmigan, the flocks of which it follows from place to place. E. W. Nelson and

L. M. Turner both corroborate its destructiveness among these birds. In some parts of the country the Goshawk hunts the ruffed grouse so persistently that it is known by the name of 'Partridge Hawk,' and this bird probably has no worse enemy except man. As Audubon was passing down the Ohio he observed one of these Hawks dive into a flock of grackles which was crossing the river, and kill four or five of them. After giving each victim a fatal squeeze the Hawk allowed it to fall to the water and at the close of the chase returned and picked up all from the surface.

Its rapid flight and the rapidity with which it makes a sudden turn enable it to capture squirrels without trouble, rabbits and mice being also taken.

A very curious performance which was enacted by this bird, with a night heron as a second party, was witnessed by Mr. H. W. Henshaw, and is as follows: "One that I shot on the Williamson's River was in hot chase of a kingfisher, which he doubtless would have seized in another moment. Another, on the same river, was noticed chasing a night heron. The attack was persistently kept up, but evidently with no intention on the part of the hawk of making the heron his prey. Forcing the heavy-winged heron into the open this hawk would close in and apparently give the ungainly bird a buffet with his wing, which each time produced a loud and discontented squawk. It occurred to me, as a possible solution of the motive of the hawk, that he intended to force his victim to throw up any fish it might have secured, and so furnish him an easy dinner." (Report of the Chief of Engineers, U. S. A., 1879, p. 2292.)

Little can be said in favor of this Hawk, as the destruction of a few injurious rodents is a very meager offset for the great number of game birds and the poultry it destroys.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.	BIRDS.
Lepus sylvaticus.	*Bonasa umbellus.*
Sciurus richardsoni.	*Colinus virginianus.*
Sciurus hudsonicus.	*Zenaidura macroura.*
Sciurus carolinensis leucotis.	

The nest is a bulky structure, and, although considerably larger, resembles quite closely in appearance that of the crow, except that it lacks the compact and nicely arranged lining common to the nest of the latter species. Externally it is composed of tolerably large sticks loosely placed together, which surround a more compact mass of smaller twigs containing the cavity of the nest. The lining is usually nothing more than a small quantity of soft inner bark, weed stalks, or leaves. The nest is situated in a large tree, generally an evergreen, well up among the higher branches, and in the thickest part of the forest.

The eggs, which are from two to five in number, three being the rule, are deposited from the middle of April to the latter part of May, according to the latitude.

DESCRIPTION.

Bare portion of leg in front shorter than middle toe; wing more than 12 inches (305^{mm}).

Adult.—Above bluish slate color with blackish shaft streaks; top of head deep black; tail crossed by four dusky bands; below white, thickly barred with narrow zigzag lines of grey; feathers often streaked in middle with dusky.

Immature.—Above, dusky greyish, feathers margined with buff; below, whitish or pale buff with narrow stripes of blackish.

Length: 21 to 25 inches (533 to 634^{mm}); extent, 42 to 46 inches (1067 to 1169^{mm}); wing, 12 to 14.25 inches (305 to 362^{mm}); tail, 9.50 to 12.75 inches (241 to 324 ^{mm}).

Table showing the results of examinations of 28 stomachs of the Goshawk (Accipiter atricapillus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Dec. 27, 1887			Rabbit	
Adirondack Mts., N. Y	Oct. 31, 1882	Ruffed grouse.		2 red squirrels	
Philadelphia, Pa	Jan. 12. 1886			Rabbit	
Dixon and Cedar counties, Nebr.	Aug. — 1867			do	Few locusts.
Tioga, Pa	Feb. 17, 1886			Mouse, weasel	
Elmira, N. Y	Apr. 12. 1886			Mice	Beetles.
Bridgeport, Conn	Oct. 29, 1888	Fowl			
Lockport, N. Y	Feb. 5, 1889	do			
Coram, Suffolk County, N. Y.	Feb. 2. 1889	do			
Grant County, N. Mex.	Sept. 4, 1886	do			30 sphinx larvæ, 3 centipeds.
Troy, N. Y	Nov. — 1878				Empty.
Saratoga County, N.Y.	Dec. — 1879				Do.
Rensselaer County N. Y.	Oct. 25, 1884	Ruffed grouse.		Gray squirrel	
Do	Dec. 29, 1884	do			
Do	Oct. 1885		Large bird		
Do	Oct. 20, 1886			Squirrel	
Huntington, N. Y	Dec. 22, 1889				Do.
San Francisco Mountain, Ariz.	Aug. 20 1889		Mourning dove		
Elk River, Minn	Feb. 10, 1890	Chicken.			
Catskill Mountains, N. Y.	Dec. 2. 1879				Do.
Camp Verde, Ariz	Dec. 2, 1886				Do.
Do	Jan. 10, 1887	Poultry.			
West Point, N. Y	Dec. 27, 1880				Do,
Saw Tooth Mountains, Idaho.	Sept. 30, 1890				Do.
Do	Sept. 28, 1890			Red squirrel	
Birch Creek, Idaho	Sept. 8, 1890				Do.
Salmon River Mountains, Idaho.	Sept. 6, 1890			do	
Morris Plains, N. J	Nov. 12, 1890	Quail			

SUMMARY.—Of 28 stomachs examined, 9 contained poultry or game birds; 2, other birds; 10, mammals; 3, insects; 1, centiped; and 8 were empty.

HARRIS'S HAWK.

Parabuteo unicinctus harrisi.

Harris's Hawk is a southern species, occurring in most portions of middle America and extending northward regularly to Texas and Arizona. The typical form, of which our bird is a geographical race, inhabits South America from Chile and the Argentine Republic northward to the isthmus of Panama. Audubon's type was secured in Louisiana, but the bird is rare in that State.

The food of this Hawk consists largely of offal, the smaller reptiles and mammals, and occasionally birds. Mr. C. C. Nutting states that a specimen obtained in Costa Rica was shot while in the act of carrying off a chicken. (Proc. U. S. Nat. Mus., vol. v, 1882, p. 404). The following is what Mr. G. B. Sennett says of its food in Texas: "I found in the crops of those I obtained, mice, lizards, birds, and often the Mexican striped gopher (*Spermophilus mexicanus*), proving them active hunters, instead of the sluggish birds they appeared the year before at Brownsville" (Bull. U. S. Geol. and Geog. Sur. Terr., vol. v, pp. 419–420).

This species, like other Hawks of the same class, does very little damage to poultry or beneficial birds. The nest is placed indifferently in bushes among the long leaves of the Spanish bayonet (yucca) or in trees to the height of 40 or 50 feet. The eggs, which are usually two or three in number, are deposited in the first or second week in April and the young make their appearance early in May. Both birds assist in incubating the eggs as well as in securing food for the young.

The species is not shy, and may be approached without much difficulty. This fearlessness on the part of the bird most probably accounts for the statements that it is peculiarly sluggish, whereas it is no more so than the other buzzard hawks.

DESCRIPTION.

Space between eyes and base of upper part of bill nearly naked. Inner webs of the five outside wing feathers cut out. Prevailing color uniform dark sooty brown; shoulders, under wing feathers, and thighs rich chestnut; tail black, with base and broad band at tip white; feathers covering base of tail white.

Length: 17.50 to 24 inches (445 to 610^{mm}); extent 43 to 47 inches (1092 to 1194^{mm}); wing 12.30 to 14.50 inches (312 to 368^{mm}); tail 9.80 to 11 inches (248 to 280^{mm}).

Table showing the results of examinations of 6 stomachs of Harris's Hawk (Parabuteo unicinctus harrisi).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Phœnix, Ariz	May 13, 1889			Small mammal.	
Do	do			Fort Yuma spermophile.	
Do	do			Spermophile	
Do	do			Small mammal	
Do	do			Rabbit hair	Cuterebra.
Rio Verde, Ariz	May 18, 1886				Empty.

SUMMARY.—Of 6 stomachs examined, 5 contained mammals; 1, insects; and 1 was empty.

RED-TAILED HAWK.

Buteo borealis.

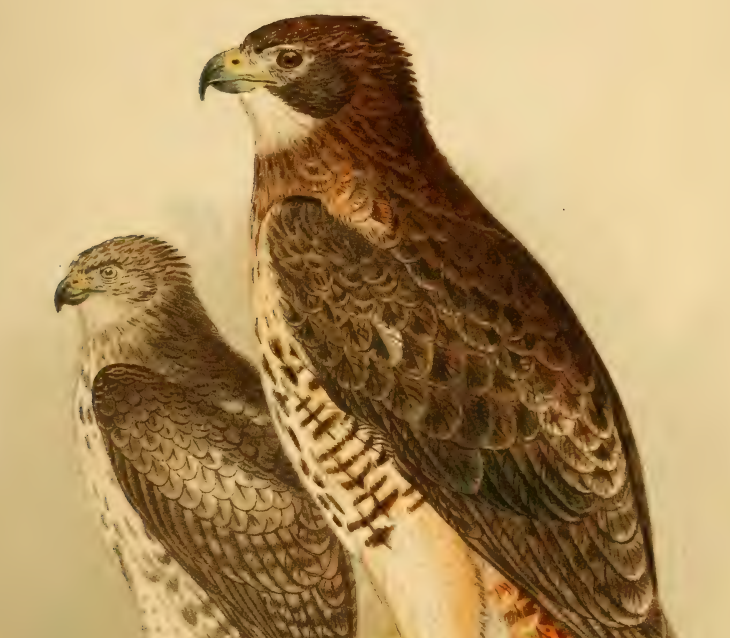
[Plate 7—Adult and immature.]

The Red-tail, or 'Hen Hawk,' as it is commonly termed, is one of the best known of all our raptorial birds. Its large size, wide distribution, and habit of frequenting open ground while hunting, cause it to be noticed by the most indifferent observer. The careful study of the food of this Hawk is of the greatest economic importance. The more so from the fact that like its congener the Red-shouldered Hawk, its inappropriate name 'Hen Hawk' stimulates an unceasing warfare against it. The farmers, who are chiefly benefited by it, are its most pronounced enemies, because of the erroneous belief that the Red-tailed Hawk is a persistent and destructive enemy of poultry.

A species as powerful and numerous as this must exert a marked influence for good or evil on agriculture, according as its food consists of beneficial or injurious forms of animal life.

Abundant proof is at hand to show that this Hawk greatly prefers the smaller mammals, reptiles, and batrachians, taking little else when these are obtainable in sufficient numbers; but if hard pressed by hunger it will eat almost any form of animal life, such as poultry and other birds, insects, crawfish, and even offal or carrion. Mr. Vernon Bailey, writing from Marfa, Tex., in January, 1890, says: "The crops and stomachs of seven contained hair and flesh of goats. A large number of goats are kept near here, and the hawks feed on those that die."

It is to be remarked that young Hawks are less particular as to the character of their food, and they are more frequently found to be the depredators of the poultry yards. The reason for this seems to be a lack of skill in procuring a sufficient quantity of the more usual prey. During winter a number of these immature birds frequent the extensive crow roost in the Arlington National Cemetery, near the city of Washington, and subsist partially on the dead and sickly crows. On one occasion, while on the river marsh below the roost in company with Mr. W. F. Roberts, the writer saw one of these birds stoop at a crow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RED-TAILED HAWK
Buteo borealis (Gmel.)

which had just been shot. During the descent the crow made considerable commotion, which evidently attracted the Hawk, for with a swiftness of flight that would have done credit to the Duck Hawk it struck the crow just as it reached the ground. In the warmer parts of the year, the Red-tail feeds quite extensively on snakes and frogs, and individuals may be seen flying with snakes in their talons, or may be started from the marshes while watching for frogs. Audubon states that he has seen it pounce on soft-shelled tortoises, but in each case the latter appeared to be successful in escaping to the water. At certain times, like the other *Buteos*, this Hawk seems to relish a diet of insects, of which grasshoppers, crickets, and the larvæ and imagos of the larger beetles form a large proportion.

Meadow mice seem to form the staple article of its food, although at times other species of mice, arboreal and ground squirrels, rabbits, or an occasional mole or shrew are found among the stomach contents. This Hawk and its allied species render valuable service in reducing the numbers of ground squirrels (*Spermophilus* and *Tamias*) and rabbits, so abundant and excessively injurious to crops in some parts of the west. In western Texas Mr. Lloyd states that the Red-tail "feeds on prairie dogs, cotton-tails, jack-rabbits, and occasionally brings a scaled quail to the young." (Auk, vol. IV, 1887, p. 188.)

Mr. William Brewster, writing of the food of this Hawk, says: "At this season [winter] it feeds exclusively on mice and rats; in early spring on toads, frogs, snakes, and the like. I doubt if it ever attacks birds, for in about a dozen specimens examined at different seasons I have never been able to detect any of their remains, nor have I ever seen it pursue one. Occasionally a wounded quail or snipe will fall a prey, but such cases must be rare." (Forest and Stream, vol. VI, 1876, p. 3.)

Joseph H. Batty writes: "The red-tailed hawk is a powerful bird, and I once saw one strike a full-grown muskrat, which it tore to pieces and devoured the greater part. * * * I have taken portions of the bodies of young woodchucks and gray rabbits from the craws of hawks of this species; it is evident that they prey largely upon mammals as well as fowl." (Forest and Stream, IV, 1875, p. 374.)

Mr. Calvin Rawson says: "In one nest of Red-tailed Hawks I have seen portions of nine red squirrels, and from another have counted out on the ground seven entire bodies. A game bird or chicken now and then, but red squirrels for everyday bill of fare." (Ornithologist and Oologist, vol. VIII, 1883, p. 17.)

Of 173 stomachs of this Hawk examined by Dr. B. H. Warren, 131 contained the remains of mice; 6, rabbits; 3, red squirrels; 2, skunks; 18, small birds; 14, poultry; 3, insects; 3, snakes; and 4, offal or carrion. He says: "I have repeatedly found three and four mice in the viscera of one bird, oftentimes five, and in a few instances as many as seven of these destructive little rodents were obtained from the crop and stomach of one hawk." (Birds of Pennsylvania, 1888, p. 86.)

Of 562 stomachs examined by the author, 54 contained poultry or game birds; 51, other birds; 278, mice; 131, other mammals; 37, batrachians and reptiles; 47, insects; 8, crawfish; 13, offal; and 89 were empty. It has been demonstrated by careful stomach examination that poultry and game birds do not constitute more than 10 per cent of the food of this Hawk, and that all the other beneficial animals preyed upon, including snakes, will not increase this proportion to 15 per cent. Thus the balance in favor of the Hawk is at least 85 per cent, made up largely of various species of injurious rodents—a fact that every thoughtful farmer should remember. It is not to be denied that a good deal of poultry is destroyed by this Hawk, but the damage done is usually among the less vigorous fowls in the late fall, and in view of the great number of injurious rodents as well as other noxious animals which this Hawk destroys it should seem equivalent to a misdemeanor to kill one, except in the act of carrying off poultry. The fact that there are robbers among Hawks is no sound argument for exterminating any and every one.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Sciurus aberti.
Sciurus carolinensis.
Sciurus c. leucotis.
Sciurus arizonensis.
Sciurus hudsonicus.
Tamias striatus.
Tamias quadrivittatus.
Spermophilus lateralis.
Spermophilus grammurus.
Spermophilus franklini.
Spermophilus tridecemlineatus.
Reithrodontomys humilis.
Mus decumanus.
Mus musculus.
Sitomys americanus.
Sitomys sonoriensis.
Neotoma mexicana.
Arvicola riparius.
Arvicola pinetorum.
Synaptomys cooperi.
Sigmodon hispidus.
Zapus hudsonius.
Erethizon dorsatus.
Lepus texianus.
Lepus sylvaticus.
Lepus s. arizonæ.
Lepus s. nuttalli.
Thomomys.
Perodipus ordii.
Mephitis mephitica.
Sorex.
Blarina brevicauda.
Blarina b. carolinensis.
Blarina exilipes.
Scalops aquaticus.

BIRDS.

Dafila acuta.
Rallus elegans.
Colinus virginianus.
Callipepla gambeli.
Bonasa umbellus.
Zenaidura macroura.
Megascops asio.
Melanerpes erythrocephalus.
Otocoris alpestris.
Corvus americanus.
Sturnella magna.
Icterus spurius.
Quiscalus quiscula.
Poocætus gramineus.
Ammodramus s. passerinus.
Spizella monticola.
Junco hyemalis.
Melospiza fasciata.
Merula migratoria.
Sialia sialis.

Like many other Hawks, the Red-tail seems to delight in circling high among the clouds, where it is barely visible from the ground or even may pass from sight in the clear space above. While thus soaring, as at other times, it utters its penetrating but not unpleasant note. On account of its usually sluggish flight it is unfitted to capture active prey, in most cases descending on it from a perch and rarely darting after it while on the wing, as is the habit of the Falcons and members of the Goshawk group. When other individuals are near, or in captivity when persons are present, it has the habit of covering its food from sight by spreading its tail and dropping the wings, and while feeding it reaches well back under the canopy thus formed, making it difficult to determine the character of the quarry.

In the East, continued persecution has made the Red-tail wary and very difficult to approach except on horseback. In parts of the West, however, where these birds are unmolested, their disposition is quite different, and they are comparatively tame. Mr. H. W. Henshaw, speaking of them at Mount Graham, Arizona, in October, says:

"Walking quietly along, there was no difficulty in approaching within a few yards of the tree where one chanced to perch. One individual which I scared from its perch by throwing a stone took a few broad circles about me, as though wondering what it meant, and then quietly returned to his former stand." (Explor. West of the 100th Merid., Wheeler, vol. v, 1875, p. 424.)

Like other birds of prey, the Red-tail, when taken young, soon becomes reconciled to captivity and makes a gentle and interesting pet. Its fondness for water is shown by the avidity with which it both bathes and drinks in the cage, as well as when free.

During migrations this Hawk often travels in large flocks and generally at a great elevation. Immense numbers pass over certain sections, which seems to be in the line of its flight. In the Hudson River valley, late in September a number of years ago, the writer observed a flock containing sixty-five individuals flying in a comparatively compact body, probably not more than a few feet from each other.

Mr. William Perham, of Tyngsboro, Mass., captured about 300 of these birds during two weeks in April, 1878 (Maynard, Birds of Eastern North America, p. 310). In winter a few hardy individuals may occasionally be found north of latitude 42°, but the great majority pass south and spread over the country even into Florida. In suitable localities, where extensive meadows and stubble fields harbor myriads of mice, these Hawks congregate in considerable numbers, as shown by the fact that about 175 specimens have been sent to the Department of Agriculture by Messrs. Miller and Leizear from a single locality in Montgomery County, Md., during the past few winters.

The increase of any animal is always followed by a relative increase of its natural enemies. This is clearly shown on the river front in the vicinity of Washington, D. C., where the recent improvements have redeemed several hundred acres of ground from the tidal flats; and already in many places rank vegetation has grown up, affording shelter and sustenance for hordes of mice. At present in winter and early spring it is not uncommon to see ten or fifteen Red-tailed Hawks in different parts of this flat attracted hither by the abundance of their natural food. Prior to the reclamation of the flats not more than a pair or two were to be seen in the same neighborhood during the winter.

The Red-tailed Hawk proper inhabits eastern North America west to the Great Plains, north at least to latitude 60°, and south to eastern Mexico, and probably breeds throughout most of this range, though more commonly north of the parallel of 40°. In the West it is separated into the three following geographical races, so that as a species its range covers the whole United States:

The Western Red-tailed Hawk (*Buteo borealis calurus*) inhabits the country west of the Rocky Mountains, as well as portions of Mexico.

Krider's Red-tailed Hawk (*Buteo borealis kriderii*) is found in the Great Plains from Minnesota to Texas, and extends east casually to Illinois.

Harlan's Red-tailed Hawk (*Buteo borealis harlani*), which until recently was considered a good species, dwells in the lower Mississippi Valley and Gulf States, east to Georgia, and extends casually to Iowa, Illinois, and Pennsylvania.

Two other races occur in North America south of the Mexican frontier, one (*Buteo borealis lucasanus*) on the peninsula of Lower California, and the other (*Buteo borealis costaricensis*) in Central America.

DESCRIPTION.

Adult.—Upper surface of tail deep rusty rufous with usually a black subterminal band; above blackish brown, variegated with gray fulvous and whitish; below white with more or less buffy, belly streaked with dusky or brown.

Immature.—Tail bright gray without any shade of red, and crossed by six to ten regular dark bands. A pronounced blackish zone across the upper part of the belly.

In Harlan's Hawk the tail is mottled with rusty, white, gray, and dusky; the rest of the plumage may vary from that of the typical red tail to nearly black.

The Western Red-tail varies from a light extreme much like the typical Red-tail to a uniform dark, sooty brown; and the tail usually has more than one dark band.

Krider's Hawk is light-colored with much white on upper parts and entirely white or pale buff on lower parts.

Length: 19 to 25 inches (482 to 635^{mm}); extent, 49 to 58 inches (1245 to 1475^{mm}); wing, 13.50 to 17.75 inches (342 to 451^{mm}); tail, 8.50 to 10.50 inches (216 to 267^{mm}).

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Taunton, Mass	Nov. 18, 1885		Feathers		
Portland, Conn	Sept. 4, 1885				2 adders, ribbon snake, toad.
Do	Nov. 25, 1885	Fowl			
Alfred Center, N. Y	Aug. 28, 1886				Grasshoppers.
Do	Oct. 25, 1886			Shrew	
Peterboro, N. Y	July 5, 1886	Fowl			
Oneida Lake, N. Y	Aug. 30, 1886			Red squirrel	
Morrisville, N. Y	Sept. 27, 1886			Meadow mouse	
Chester County, Pa	May 15, 1886	Fowl	Oriole	Rabbit	Grubs.
Do	Mar. 10, 1886			Meadow mouse	
Birmingham, Pa	Mar. 15, 1886	Fowl	Grackle		
Portland, Conn	July 25, 1886				Empty.
Chickamauga, Tenn	Feb. 13, 1886				Offal.
Lockport, N. Y	July 13, 1886			4 meadow mice	Toad, 2 beetles.
Forge, Suffolk County, N. Y.	Feb. 16, 1887	Fowl			
Whitewater, Wis	Aug. 17, 1887			Meadow mouse	13 grasshoppers, 5 crickets, 1 beetle, 1 crawfish.
Washington, D. C	May 4, 1887			Pine mouse, meadow mouse.	Large adder.
Middletown, Conn	Nov. 20, 1886			Mouse	5 grasshoppers.
Portland, Conn	Dec. 29, 1886			Gray squirrel	
Gainesville, Va	Jan. 2, 1888			2 house mice	
Howard County, Md	Nov. 3, 1887				Empty.
Washington, D. C	Dec. 29, 1887		Song sparrow	Meadow mouse	
Do	Jan. 20, 1888			House mouse, 3 meadow mice.	
Sing Sing, N. Y	Feb. 18, 1885			4 meadow mice, 2 white-footed mice, shrew.	
Do	Apr. 13, 1885			2 shrews	
Lewis County, N. Y	Aug. 3, 1876				Garter snake.
Portland, Conn	Mar. 2, 1887				Empty.
Troy, Pa			Screech owl		
Devils Lake, N. Dak	Aug. 11, 1887			Gray gopher, striped gopher.	Frogs, 10 large grasshoppers.
East Hartford, Conn	Sept. 14, 1885				2 frogs, potato beetle.
Sandy Spring, Md	Jan. 8, 1887			Pine mouse, shrew.	
Do	do			2 meadow mice	
Do	do			Meadow mouse, white-footed mouse, shrew.	
Do	do			4 house mice, 1 meadow mouse.	
Do	do			3 house mice, 1 meadow mouse, shrew.	
Do	do			3 meadow mice	
Do	do			3 meadow mice, 3 shrews.	
Do	do			1 house mouse, 2 pine mice, 2 meadow mice, 1 shrew.	
Do	Jan. 14, 1887				Empty.
Do	do			1 pine mouse, 2 meadow mice.	
Do	Jan. 22, 1887			Meadow mouse	
Do	do			do	
Do	do			do	
Do	Jan. 28, 1887			do	
Do	do		Crow	do	
Do	do		do		
Do	Feb. 11. 1887				Do.
Do	do			Meadow mouse	Larva.
Do	do			Pine mouse, meadow mouse.	
Do	Mar. 2, 1887			Shrew	
Do	do				Do.
Do	do			Meadow mouse, 2 house mice.	
Do	do			1 meadow mouse, 1 house mouse.	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Mar. 2, 1887			2 meadow mice, gray squirrel.	
Do	do			Meadow mouse	
Do	do			Shrew	
Do	do				Empty.
Do	do	Fowl			
Do	do			5 meadow mice	
Do	do		Bluebird	Meadow mouse	
Do	do		Tree sparrow		Grasshopper.
Do	do			Meadow mouse	
Do	do			do	
Do	Mar. 5, 1887		2 song sparrows.	do	
Do	do			Meadow mouse, white-footed mouse, mole.	
Do	do		Song sparrow	Rabbit	
Do	do		Feathers		
Do	do				Empty.
Do	do			2 meadow mice, rabbit.	
Do	Mar. 8–10, '87			Meadow mouse	2 wood frogs.
Do	do			do	
Do	do				Empty.
Do	do			3 meadow mice	
Do	do			2 moles	
Do	do			Shrew	
Do	do			Rabbit	
Do	do			do	
Do	do			Gray squirrel	
Do	do			Meadow mouse, chipmunk.	Crawfish.
Do	Mar. 12, 1887		Feathers		
Do	Mar. 18, 1887		Robin	Meadow mouse	
Do	Mar. 24, 1887			3 meadow mice	
Do	Apr. 1, 1887		2 sparrows	Meadow mice	
Do	do			Pine mouse	
Do	Apr. 25, 1887			Mole	Insect remains.
Do	Apr. 28, 1887			Meadow mouse, gray squirrel.	
Do	Nov. 14, 1887				Empty.
Do	do				Do.
Do	do				Do.
Do	Nov. 27, 1887			Gray squirrel	
Do	Dec. 12, 1887				Do.
Do	do			House mouse	
Do	Dec. 24. 1887			2 meadow mice	
Do	Dec. 26, 1887				Do.
Do	do			1 house mouse, 1 meadow mouse, 3 shrews.	
Do	do			Meadow mouse	
Do	do				Do.
Do	Jan. 3, 1888			2 meadow mice	
Do	Jan. 7, 1888			Meadow mouse	
Do	Jan. 14, 1888		Meadowlark	3 meadow mice	
Do	Jan. 11, 1888			2 house mice	
Do	Jan. 14, 1888	Fowl			
Do	Jan. 19, 1888			5 meadow mice	
Do	Jan. 30, 1888		Crow		
Do	Jan. 28, 1888			Meadow mouse	
Do	Jan. 30, 1888		Crow	House mouse	
Do	Feb. 13, 1888				Do.
Do	Feb. 18, 1888				Do.
Do	Feb. 22, 1888				Do.
Chester County, Pa	May, 1886	Fowl	Oriole	Gray squirrel	
Do	Oct. 15, 1886			House mouse	
Do	Nov. 22. 1886			Meadow mouse	
Do	Nov. 16, 1886	Fowl		do	
Do	Dec. 4, 1886				Do.
Do	Dec. 8, 1886				Offal.
Do	Dec. 29, 1886			4 meadow mice	
Do	Feb. 11, 1887				Empty.
Do	Feb. 16, 1887				Do.
Do	Dec. 11, 1886		Sparrow		
Do	Jan., 1887	Fowl		Meadow mouse	
Do	Dec. 11, 1886				Do.
Do	Dec., 1886			House mouse, meadow mouse.	
Do	do		Song sparrow	2 meadow mice	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (*Buteo borealis*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Nov., 1886		Song sparrow	Pine mouse	
Do	do			do	
Do	Feb. 16, 1887	Fowl			
Do	Dec., 1886	do		Meadow mouse, 2 house mice.	
Do	Dec. 11, 1886			7 house mice	
Do	Dec. 18, 1886				Empty.
Do	Apr. 20, 1886			Mouse	Beetles.
Do	Dec. 28, 1886			4 meadow mice	
Do	Nov., 1886				Empty.
Do	do			Meadow mouse	
Do	do			2 meadow mice	
Do	do			3 meadow mice	
Do	do			2 meadow mice	
Do	Dec. 28, 1886			1 meadow mouse	
Do	do			Meadow mice, rabbit.	
Do	do			5 meadow mice	
Do	Jan. 15, 1887	Fowl			
Do	Nov., 1886			2 house mice, 1 meadow mouse.	
Do	do			3 meadow mice	
Do	Jan., 1887			2 meadow mice, mole.	
Do	do			Meadow mouse, rabbit, shrew.	
Do	do			Meadow mouse, red squirrel.	
Do	do			3 meadow mice	
Do	Oct., 1886			3 meadow mice, red squirrel.	
Do	Dec., 1886			4 meadow mice	
Do	do			1 meadow mouse	
Do	Jan., 1887		Feathers	do	
Do	do			Rabbit	
Do	do		Feathers		
Do	Dec., 1886			3 meadow mice	
Do	Oct., 1886			Red squirrel	
Do	Dec., 1886	Fowl		House mouse	Grasshopper.
Do	do	do			
Do	Jan. 25, 1887			House mouse	
Do	do			Meadow mouse, white-footed mouse.	
Do	Jan. 26, 1887			Meadow mouse	
Do	do			6 meadow mice	
Do	Dec. 31, 1886			Mouse	
Do	Jan. 1, 1887			White-footed mouse, shrew.	
Do	Jan. 3, 1887			Meadow mouse	
Do	Jan. 7, 1887			Mouse	
Do	Jan., 1887			Meadow mouse	
Do	do			2 meadow mice	Frog.
Do	do			2 meadow mice, shrew.	
Do	do			1 meadow mouse	
Do	do			Meadow mouse	
Do	do			do	
Do	do			do	
Do	Jan. 18, 1887		Meadowlark		
Do	Jan. 17, 1887			House mouse	
Do	Jan. 22, 1887			5 meadow mice	
Do	Nov., 1886			Mouse	
Do	Dec., 1886			Red squirrel	
Do	Nov., 1886			Meadow mouse; red squirrel.	
Do	do			Meadow mouse	
Do	Jan., 1887		Tree sparrow		
Do	do				Empty.
Do	do		Crow		
Do	do			Meadow mouse	
Do	do			2 meadow mice, white-footed mouse.	
Do	Feb., 1887			Meadow mouse	
Do	do			do	
Do	do			6 meadow mice	
Do	do			Meadow mouse, shrew.	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (*Buteo borealis*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Feb. 1887			3 meadow mice, 2 house mice.	
Do	do				Offal.
Do	Mar. 10, 1887			Shrew	
Do	do			Meadow mouse	
Do	do			2 meadow mice	
Do	Feb., 1887			7 meadow mice	
East Bradford, Pa	Feb. 4, 1879			Mice	
Westtown, Pa	Jan. 5, 1881				Grasshoppers.
East Bradford, Pa	Feb. 15, 1879			Mice	
Do	do			do	
Do	do			do	
Williamstown, Pa	Apr. 4, 1878			do	
Westtown, Pa	Mar. 11, 1879			do	
Pocopson, Pa	Nov. 25, 1878	Quail			
Willistown, Pa	Jan. 3, 1879			Mice	
West Bradford, Pa	Jan. 13, 1879	Poultry			
Kennett, Pa	Jan. 15, 1879	do			
Do	do			Mice	
Willistown, Pa	Jan. 21, 1879			do	
Do	do			do	Insects.
East Bradford	Mar. 24, 1879			do	Do.
Do	Dec. 25, 1884			do	
Chester County, Pa	Feb. 15, 1878			do	
Birmingham, Pa	Dec. 31, 1884	Poultry			
Willistown, Pa	Jan. 6, 1885			Mice	
Do	do			do	
East Bradford, Pa	do			do	
Chester County, Pa	Jan. 5, 1881				Grasshoppers.
Willistown, Pa	Feb. 15, 1878			Mice	
Do	Oct., 1876		Small bird	Rabbit	
East Bradford, Pa	Aug. 15, 1876		do		
Willistown, Pa	Apr. 8, 1877	Poultry		Mice	
Do	do	do			
Lancaster County, Pa	Apr. 2, 1878			Mice	
West Bradford, Pa	Nov. 25, 1879	Quail			
East Bradford, Pa	Feb. 4, 1879			Mice	
Caln, Pa	Feb. 22, 1879			do	
Do	do			do	
Westtown, Pa	Jan. 23, 1879			do	
Do	do			do	
East Bradford, Pa	Jan. 20, 1879			do	
Westtown, Pa	Jan, 28, 1879			do	
Do	do			do	
Do	Jan. 20, 1879			do	
Do	do			do	
East Bradford, Pa	Feb., 1879			do	
Do	do			do	
Lancaster County, Pa	Apr. 2, 1878			do	
East Bradford, Pa	Feb., 1879			do	
Westtown, Pa	Jan. 28, 1879			do	
Chester County, Pa	do				Offal.
Pocopson, Pa	Feb. 8, 1879			Mice	
Caln, Pa	Feb. 9, 1879			do	
West Goshen, Pa	Feb. 7, 1879			do	
Westtown, Pa	Jan. 29, 1879			do	
Maryland	Feb., 1879			Red squirrel, mice.	
East Bradford, Pa	Feb. 8, 1879			Mice	
Willistown, Pa	Jan. 21, 1879			do	
West Whiteland, Pa	Mar., 1879			3 mice	
Willistown, Pa	Jan. 13, 1879			Mice	
Chester County, Pa	Jan. 3, 1879	Poultry			
West Bradford, Pa	Jan. 3, 1880	do			
Willistown, Pa	Nov. 27, 1874			Red squirrel	
East Bradford, Pa	Dec., 1882			Red squirrel, mice.	
Willistown, Pa	Jan., 1882			Rabbit	
Westtown, Pa	Jan. 5, 1881			Mice	Grasshoppers and crickets.
Willistown, Pa	Jan. 2, 1880			do	Insects.
West Bradford, Pa	Nov. 27, 1880			do	
Willistown, Pa	Mar. 27, 1880		Small bird	do	
Do	Mar. 22, 1880	Quail			
East Goshen, Pa	Mar. 20, 1880			Red squirrel, mice.	
Willistown, Pa	do			Mice	
Birmingham, Pa	Feb. 26, 1880			do	
Delaware County, Pa	Feb. 23, 1880			do	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Delaware County, Pa	Feb. 23, 1880			Mice	
Do	Jan. 30, 1880			do	
Westtown, Pa	Dec. 5, 1879			do	
Chester County, Pa	Dec. 3, 1879	Poultry			
Do	do			Mice	
New Garden, Pa	Nov. 26, 1879			do	
East Goshen, Pa	Sept. 15			do	
Chester County, Pa	Dec. 10, 1877	Poultry			
Do	Oct. 3, 1880			Mice	
Willistown, Pa	Feb. 1876		Feathers		
Do	Jan. 20, 1876			Mice	
Do	Jan. 1876			do	
Do	Dec. 19, 1878			do	
Do	Jan. 18, 1875			do	
Do	Nov. 20, 1876			do	
Do	Mar. 26, 1876			do	
Chester County, Pa	Sept. —, 1874			Gray squirrel	
West Goshen, Pa	Dec. —, 1875			Mice	
East Goshen, Pa	Feb. 19, 1876				Empty.
Dakota City, Nebr	July, 1870	Quail			37 insects.
Elmira, N. Y	June 1, 1886			Rat, red squirrel	
Do	June 19, 1886	Chicken			
Do	July 21, 1886				Grasshopper, beetles.
Do	Oct. 2, 1886			3 mice	
Wellsburg, N. Y	Apr. 7, 1887			Hair	Beetles.
Halsey Valley, N. Y	Aug. 10, 1887			2 mice	Grasshoppers.
Sandy Spring, Md	Mar. 6, 1888		Tree sparrow		
Do	do		2 tree sparrows, 1 song sparrow.	Meadow mouse	
Do	Mar. 7, 1888				Empty.
Do	do				Do.
Do	do		Song sparrow, junco.	Meadow mouse, rabbit.	
Do	Mar. 9, 1888			Mole	
Do	Mar. 15, 1888				Do.
Do	do		Song sparrow	Meadow mouse	
Do	do			2 house mice	
Do	Mar. 17, 1888			Shrew	
Do	do			Meadow mouse	
Do	Mar. 19, 1888			do	
Gainesville, Fla	Jan. 4, 1888			2 cotton rats	
Sandy Spring, Md	Mar. 24, 1888			1 pine mouse, 1 meadow mouse.	
Chester County, Pa	Feb. —, 1887			2 meadow mice	
Do	Jan. —, 1887			do	
Do	Apr. —, 1887			3 meadow mice	
Do	Feb. —, 1887			Meadow mice	
Do	do			do	
Do	do			do	
Do	do			do	
Sandy Spring, Md	Mar. 28, 1888				Toad, crawfish.
Do	Mar. 30, 1888			2 meadow mice	May beetle, other insects.
Do	Apr. 18, 1888				Empty.
Portland, Conn	Oct. 8, 1887			Mouse	
East Hartford, Conn	Apr. 6, 1888			Meadow mice	
Do	do	Ruffed grouse.			Garter snake.
Do	Apr. 20, 1888			Shrew; meadow mouse.	
Lockport, N. Y	June 11, 1888	Chicken.			
East Hartford, Conn					Empty.
The Plains, Va	Sept. 5, 1888				Insect.
Sandy Spring, Md	Oct. 2, 1888		Red headed woodpecker.	Pine mouse, gray squirrel.	2 cuterebrae and other insect.
Do	Nov. 11, 1888				Offal.
Do	Nov. 12, 1888			Shrew	Snake; grasshopper.
Do	Nov. 13, 1888				Empty.
Washington, D. C	Dec. 4, 1888			1 house mouse, 1 meadow mouse	
Cobham, Va	Dec. 1, 1888				Do.
Sandy Spring, Md	Dec. 9, 1888				Do.
Do	Dec. 19, 1888			Gray squirrel	
Do	Dec. 18, 1888			Mouse hair	
Do	do			2 meadow mice	
Do	Dec. 24, 1888				Offal.

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (*Buteo borealis*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Dec. 24, 1888			1 meadow mouse	
Do	Jan. 9, 1889				Indeterminate matter.
Do	Jan 19, 1889			Mouse hair	
Do	do			do	
Do	Jan. 22, 1889				Empty.
Do	Feb. 3, 1889		Crow		
Do	Mar. 12, 1889				Empty.
Leopard, Pa	Mar. 10, 1888			2 meadow mice	
Sandy Spring, Md	Apr. 2, 1889			Gray squirrel	
Do	Apr. 4, 1889	Fowl			
Rayne, La	Mar. 5, 1889				6 crawfish; 1 frog.
Owego, N. Y	July 23, 1889			Rabbit, meadow mouse.	Adder, crawfish, grasshoppers, beetles.
Alfred Center, N. Y	May 28, 1889			Meadow mouse, 3 shrews.	
San Francisco Mountain, Arizona.	Aug. 3, 1889			1 Say's chipmunk.	
Do	Aug. 5, 1889			1 Rocky Mountain chipmunk.	
Do	do				Empty.
Do	Aug. 6, 1889				Do.
Do	Aug. 26, 1889			1 Say's chipmunk.	
Do	do			1 Rocky Mountain chipmunk, 1 white-footed mouse.	
Do	Sept. 1, 1889				4 large grasshoppers.
Do	Sept. 16, 1889			1 Say's chipmunk, 1 Rocky Mountain chipmunk.	
Do	Sept. 22, 1889			1 Rocky Mountain chipmunk.	2 grasshoppers.
Do	Sept. 24, 1889			do	
Do	Sept. 27, 1889			2 Rocky Mountain chipmunks.	
Do	Oct. 5, 1889			1 Abert's squirrel.	
Deming, N. Mex	Nov. 29, 1889			1 pocket rat	
Sandy Spring, Md	Nov. 17, 1889			Mouse hair	
Do	do	Poultry			
Do	do				Empty.
Do	Nov. 19, 1889				Do.
Do	do			1 shrew	
Do	Nov. 23, 1889			2 meadow mice; 2 shrews.	
Do	Nov. 29, 1889	Quail		Gray squirrel	
Do	Dec. 3, 1889				Do.
Do	Dec. 7, 1889			1 rat	
Do	Dec. 12, 1889			Meadow mouse	
Kalamazoo, Mich	1886	Poultry			
Do	1886			Gopher	
Do	1886			do	
East Bradford, Pa	May 10, 1886	Poultry			
Do	Aug. 28, 1886		Small bird		
Birmingham, Pa	Nov. 27, 1886			4 mice	
Alder Creek, N. Y	Sept. 22, 1886			Meadow mouse; porcupine.	Grasshoppers.
Woodland, Cal	May 24, 1886		Small bird	Rat	
Fort Hamilton, N. Y	Dec. 18, 1880		Shore lark	Mole	
Bayou La Barre, La	Dec. 8, 1888			Rabbit	
New Orleans, La	Jan. 30, 1889		King Rail		
Raleigh, N. C	Dec. 3, 1887				Empty.
Do	Feb. 14, 1888	Poultry			
Mount Carmel, Ind	Nov. 19, 1886			2 meadow mice	
Brookville, Ind	Nov. 22, 1886			Rabbit	
Do	Dec. 4, 1886			Short-tailed shrew.	
Adams, Ind	Jan. 4, 1887	Quail		Rabbit	
Union County, Ind	Jan. 11, 1887			White-footed mouse.	
Do	do			Mice	
Adams, Ind	Jan. 12, 1887			Meadow mouse	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Adams, Ind	Jan. 26, 1887			2 white-footed mice; 1 other mouse.	
Do	Jan. 27, 1887		Sparrow (?)	Meadow mouse	Crawfish.
Decatur County, Ind	Feb. 12, 1887			Skunk	Do.
Do	do			4 meadow mice; 1 white-footed mouse.	
Springfield, Ind	Mar. 7, 1887				Frog.
Brookville, Ind	Mar. 19, 1887			2 white-footed mice.	
Do	Nov., 1887				Empty.
Do	Nov. 17, 1887			Rabbit	
Fairfield, Ind	Nov. 30, 1887	Chicken			
Brookville, Ind	Dec. 14, 1887	do			
Whitcomb, Ind	Mar. 1, 1888				Garter snake.
Springfield, Ind	Mar. 7, 1888				Empty.
Do	do				Do.
Rensselaer County, N. Y.	Nov. 23, 1878			Mouse hair	Frogs.
Do	Oct. 25, 1884				35 grasshoppers.
Do	Oct. 9, 1885			Meadow mice	
Do	Oct. 3, 1886				Grasshoppers.
Do	Oct. 28, 1887				Cricket.
Do	Oct. 29, 1887			White-footed mouse, 1 meadow mouse.	
Saratoga County, N. Y.	Nov. 8, 1879			Red squirrel	Frog.
Albany County, N. Y.	Nov. 3, 1884				Grasshoppers, garter snake.
Do	Nov. 8, 1886			2 rats	
Troy, N. Y	Nov., 1886				Empty.
Do	Dec. 19, 1887				Do.
Rensselaer County, N. Y.	Oct. 20, 1888				Frog, grasshoppers, crickets, other insects.
Do	Nov. 3, 1888			Meadow mice	Frogs, grasshoppers.
Jefferson, Md	Dec. 12, 1889			3 meadow mice	2 grasshoppers.
Gaylordsville, Conn	Jan., 1889			2 short-tailed shrews; 2 meadow mice.	
Jefferson, Md	Dec. 14, 1889	Fowl			
Sandy Spring, Md	Dec. 27, 1889			Meadow mouse	
Do	Jan. 8, 1890				Empty.
Do	do			Meadow mouse	
Do	do		Feathers		
Hale County, Ala	Jan. 4, 1890			Harvest mouse	
Lockport, N. Y	Jan. 29, 1890			Short-tailed shrew.	
Amagansett, N. Y.	June 29, 1889			2 meadow mice	
Greensboro, Ala	Feb. 12, 1890			Cotton rat, 2 white-footed mice.	
Toronto, Canada	Feb. 17, 1890				Offal.
Sandy Spring, Md	Feb. 27, 1890				Empty.
Do	Mar. 10, 1890			1 short-tailed shrew, 2 meadow mice.	
Do	Mar. 13, 1890		2 song sparrows		Toad.
Do	Mar. 17, 1890			Short-tailed shrew.	
Do	Mar. 18, 1890				Empty.
Do	do			Meadow mouse, pine mouse.	
Do	Mar. 24, 1890			Rabbit	
Do	do			2 short-tailed shrews, 1 Cooper's mouse, 1 pine mouse.	
Do	Apr. 2, 1890			2 meadow mice	
Do	do		Robin	2 meadow mice, 2 shrews.	
Do	Apr. 3, 1890			2 meadow mice	
Bellefontaine, Ohio	July 6, 1889	Poultry			Snake, stag beetle, small beetles, crawfish, two fly larvæ.

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Marfa, Tex	Jan. 21, 1890				Goat offal.
Do	do				Do.
Do	Jan. 20, 1890				Do.
Do	Jan. 21, 1890				Do.
Do	do			Rabbit	Do.
Do	do			do	
Do	do				Goat offal.
Do	Jan. 19, 1890		Bird	Rock squirrel	
Orange County, N. Y	Oct. 11, 1873	Ruffed grouse.			
Highland Falls, N. Y	Apr. 1, 1875				Empty.
Putnam County, N. Y	Apr. 5, 1879				Do.
Circleville, Ohio	Apr. 1, 1881				Do.
Camp Verde, Ariz	Apr. 10, 1884				Do.
Yavapai County, Ariz	Sept. 25, 1884			Arizona rabbit	
Do	do			do	
Mogollon Mountains, Ariz.	Oct. 5, 1884				Do.
Pine Springs, Ariz	Nov. 17, 1884			Rabbit	
Whipple Barracks, Ariz.	Nov. 25, 1884			Arizona rabbit	
Camp Verde, Ariz	Mar. 14, 1885				Do.
Yavapai County, Ariz	Mar. 25, 1885			Arizona rabbit	
Fort Lowell, Ariz	Apr. 5, 1885				Do.
Red Rock, Ariz	May 8, 1885				Small snakes.
Yavapai County, Ariz	May 19, 1885				Empty.
Camp Verde, Ariz	Aug. 24, 1885			Arizona rabbit	
Do	Aug. 25, 1885			Pocket gophers	
Yavapai County, Ariz	Aug. 27, 1885				Do.
Do	Sept. 13, 1885				Diamond rattle snake.
Camp Verde, Ariz	Oct. 10, 1885			Pocket gopher	
Do	Oct. 16, 1885				Striped snake.
Do	Dec. 18, 1885				Empty.
Do	Dec. 28, 1885				Do.
Do	Jan. 14, 1886			Arizona rabbit	
Upper Verde Valley, Ariz.	Mar. 9, 1886			Jack rabbit	
Camp Verde, Ariz	Mar. 12, 1886				Do.
Do	Sept. 7, 1886		Mourning dove		
Do	Oct. 17, 1886				Do.
Do	Nov. 25, 1886				Diamond rattle snake.
Do	Dec. 1, 1886			Arizona rabbit	
Do	do				Snakes.
Do	Dec. 11, 1886				Empty.
Do	do				Do.
Do	do			Pocket gopher	
Do	Dec. 13, 1886			do	
Do	Dec. 27, 1886				Do.
Oak Creek, Ariz	Jan. 6, 1887				Do.
Yavapai County, Ariz	Jan. 6, 1887			Wood rats	
Camp Verde, Ariz	Jan. 16, 1887	Gambel's quail.			
Do	do			Mexican wood-rat.	
Pecks Lake, Upper Verde Valley, Ariz.	Jan. 24, 1887	Pintail			
Camp Verde, Ariz	Mar. 31, 1887	Teal	Mourning dove		
Do	do				Do.
Upper Verde Valley, Ariz.	Apr. 16, 1887			Texas jack rabbit.	
Do	do			do	
San Francisco Mt., Ariz.	June 12, 1887			Say's chipmunk	
Do	June 13, 1887				Do.
Mogollon Mts., Ariz	July 15, 1887				Do.
Do	July 17, 1887			Abert's squirrel	
Tonto Basin, Ariz	Aug. 10, 1887			Arizona squirrel	Lizards.
Camp Verde, Ariz	Oct. 25, 1887				Small snake.
Do	do				Empty.
Do	Nov. 1, 1887				Do.
Do	Nov. 5, 1887				Do.
Do	Nov. 26, 1887				Grasshoppers, bull snake.
Upper Verde Valley, Ariz.	Dec. 8, 1887				Empty.
Camp Verde, Ariz	Jan. 7, 1888				Frogs.

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Payson, Ariz	Feb. 10, 1888	Gambel's quail.		Kangaroo rat	
Yavapai County, Ariz	May 8, 1888				Small striped snake.
Vermillion, Clay County, S. Dak.	Apr. 1, 1890	Wild duck.			
Do	Apr. 9, 1890				Empty.
Do	do			Striped gopher	
Sandy Spring, Md	Oct. 6, 1890	Fowl			
Do	Oct. 22, 1890	do			
Plover Mills, Ontario	May 8, 1884			2 meadow mice.	
Keokuk, Iowa	Dec. 22, 1889			Mice	
Sandy Spring, Md	Nov. 6, 1890			Meadow mouse.	
Do	do				8 grasshoppers.
Portland, Conn	Oct. 4, 1890			Red squirrel, shrew.	Larva.
Do	Oct. 22, 1890				Empty.
Sandy Spring, Md	Nov. 9, 1890			Chipmunk	
Do	do			Red squirrel	Wood frog, spider, grasshopper, snake.
Do	Nov. 13, 1890				Empty.
Do	Nov. 15, 1890			Meadow mouse, short-tailed shrew.	Grasshopper.
Do	Nov. 17, 1890			House mouse	
Do	Nov. 18, 1890			Meadow mouse.	
Do	Nov. 20, 1890				Empty.
Do	do			2 meadow mice, 1 jumping mouse.	
Do	Nov. 28, 1890				Do.
Union County, Ky	Oct. 22, 1890	Chicken.			
Do	Nov. 5, 1890				Toad.
Sandy Spring, Md	Dec. 13, 1890				Empty.
Dover, N. J	Oct. 18, 1890			1 short-tailed shrew.	2 grasshoppers.
Morristown, N. J	Nov. 1, 1890			1 small shrew, 1 meadow mouse.	
Do	Nov. 15, 1890	Chicken.			
Morristown, N. J	Nov. 17, 1890				Empty.
Sandy Spring, Md	Dec. 29, 1890				Do.
Do	Jan. 10, 1891			1 meadow mouse, 1 small short-tailed shrew.	
Buffalo, N. Y	Oct. 22, 1890				5 grasshoppers.
Herrick, Pa	July 1, 1891			Chipmunk	Frog.
Drewrys Bluff, Va	Feb. 5, 1891			Mouse hair	
Washington, D. C	Nov. 20, 1891	Chicken.		Pine mouse	
Sandy Spring, Md	Dec. 1, 1891			Rabbit	
Do	Dec. 15, 1891				Empty.
Lancaster County, Pa	do				Do.
Portland, Conn	Aug. 2, 1891			1 meadow mouse.	
Do	Oct. 31. 1891				Do.
Do	Nov. 12. 1891	Chicken.			
Sandy Spring, Md	Jan. 6, 1892			House mouse	
Fort Huachuca, Ariz	Apr. 30. 1892				1 striped snake, 5 centipeds.
Sandy Spring, Md	Jan. 11, 1891				Empty.
Do	do			Mouse hair	
Do	Jan. 20, 1892			1 house mouse, 1 short-tailed shrew.	
Do	Mar. 14, 1892		3 juncos, 1 song sparrow.		
Do	Mar. 21, 1892		2 song sparrows, 1 junco.	2 meadow mice, 1 white-footed mouse.	
Do	Mar. 14, 1892			Gray squirrel	
Do	Mar. 17, 1892		1 junco, 1 song sparrow.	Mouse hair	
Do	Mar. 16, 1892				Do.
Do	Mar. 2, 1891				Do.
Do	Mar. 21, 1891			2 meadow mice	
Do	Mar. 14, 1891			1 meadow mouse, gray squirrel.	
Do	do			1 rat, 1 house mouse, 2 meadow mice.	

Table showing the results of examinations of 562 stomachs of the Red-tailed Hawk (Buteo borealis)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Jan. 26, 1891			House mouse	
Do	Feb. 12, 1891			2 meadow mice	
Do	Jan. 26, 1891			3 meadow mice	
Do	Mar. 2, 1891				Empty.
Do	Dec. 13, 1890			3 meadow mice	
Panamint Mts., Cal	June 23, 1891			Pouched gopher	2 lizards, 5 grasshoppers, 1 mole cricket.
Walker Pass, Cal	July 3, 1891				Empty.

SUMMARY.—Of 562 stomachs examined, 54 contained poultry or game birds; 51, other birds; 278, mice; 131, other mammals; 37, batrachians or reptiles; 47, insects; 8, crawfish; 1, centipeds; 13, offal; and 89 were empty.

RED-SHOULDERED HAWK.

Buteo lineatus.

[Plate 8—Adult.]

The Red-shouldered Hawk inhabits eastern North America from Nova Scotia and Manitoba ranging south to the Gulf of Mexico and west to the Great Plains.

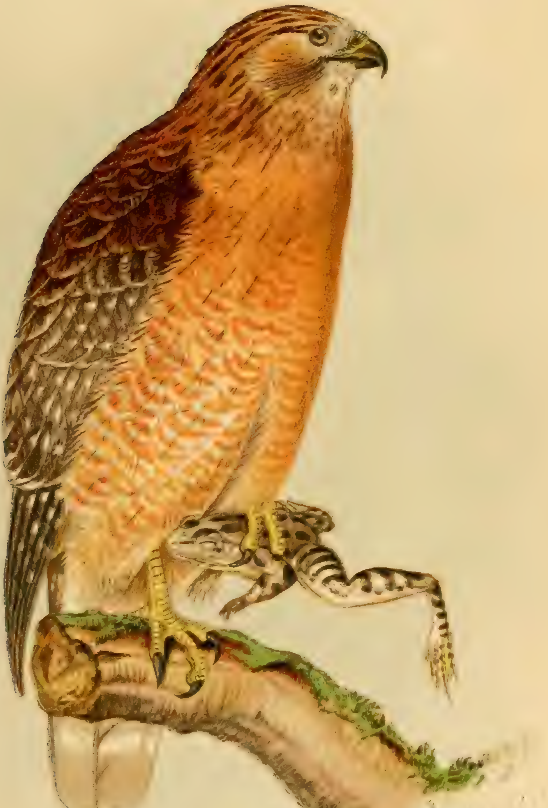
A dark race (*Buteo lineatus elegans*) inhabits the Pacific slope, north to southern Oregon.

A small race (*Buteo lineatus alleni*) occurs from Florida to Texas, and extends south into Mexico. It is well to state here that, although the Texas and Mexican specimens are of the same size as typical Florida examples, they are much darker, owing to the increase of the rufous pigment in the plumage, thus approaching the *elegans* type in coloration.

It will be seen from the above outline of its distribution that a considerable portion of the dry interior of the United States, including the Great Plains region, is without a representative of this species.

The diet of the Red-shouldered Hawk is probably more varied than that of most other birds of prey. For example, the writer has found in the stomachs of the different individuals which have come under his notice the remains of mammals, birds, snakes, frogs, fish, insects, centipeds, spiders, crawfish, earthworms, and snails, which represent eleven classes of animal life. This Hawk is very fond of frogs, and, although these batrachians are mentioned by Audubon and other writers as forming a very considerable portion of their sustenance, yet mice furnish fully 65 per cent of their food. Besides this very injurious group of rodents, other small mammals, such as squirrels, young rabbits, shrews, and moles, are taken.

Some authors have stated that Hawks commonly commence on their prey by eating the entrails. The tame Hawk elsewhere mentioned, and others that have come under the writer's observation, invariably



RED-SHOULDERED HAWK

Buteo lineatus (Gmel)

ate the eyes and brains first, even when the animal's abdominal cavity was opened, and in most cases discarded the stomach and large intestines altogether.

Some authors insist that the Red-shouldered Hawk is destructive to poultry, but the writer in all his field experience has never seen one attack a fowl, nor has he found the remains of one in the stomachs of those examined. In making this statement, he does not include poultry which is eaten in the form of offal, for in severe weather when the ground is covered with snow and when food is scarce, the Red-shouldered Hawk will devour dead chickens which have been thrown out from the yard, as well as other refuse found on the compost heaps or in the vicinity of slaughterhouses. At such times the writer has often captured specimens of this Hawk, as well as of crows, blue jays, red and flying squirrels, in steel traps set near a piece of chicken, rabbit, or beef fastened in a tree.

In a communication received by the U. S. Department of Agriculture from Mr. J. Alden Loring, of Owego, Tioga County, N. Y., in September, 1889, he gives the following testimony in reference to this bird: "The pair reared their young for two years in a small swampy piece of woods about 50 rods from a poultry farm containing 800 young chickens and 400 ducks, and the keeper told me he had never seen the hawks attempt to catch one." It is extremely improbable that this slow-flying Hawk often captures birds, except such as are disabled.

Frogs are eagerly sought after. The tame Hawk mentioned below always took them in preference to anything else except a live mouse. Toads also furnish food for it, especially in the spring, when they are in the water spawning. Small and medium sized snakes are often found among the stomach contents, and occasionally the Hawk is seen flying with one of these reptiles dangling from the talons. Dr. C. Hart Merriam says: "I once took from the stomach of one of these hawks a snake (*Eutainia saurita*) measuring 22 inches in length." (Birds of Connecticut, 1877, p. 86.) Crawfish, in sections of the country where they abound, are often taken by this Hawk, as by most of the other *Buteos*. Maynard, after telling how this Hawk has learned to visit the poultry yard, states: "In Florida I found them feeding upon small mammals, reptiles, crabs, and other crustaceans." (Birds Eastern N. Am., p. 312.)

Among the insects which are destroyed in considerable numbers by this bird, may be mentioned grasshoppers, crickets, and various kinds of beetles and caterpillars. Even in December and early January, when apparently all insect life is in a dormant state, specimens of the Red-shouldered Hawk are found whose stomachs are filled with one or more species of these insects.

Mr. Benjamin Mortimer, whose observations were made in Florida, makes the following statement as to its food: "This is the most troublesome of the hawks among young chickens in Orange County. The numerous bay-tree swamps are its favorite residence, as they serve as a safe stronghold, and also harbor myriads of cotton rats, which are a favorite prey with it. It would appear that this Hawk is not in the habit of molesting the common small birds, as I have observed numbers of Blackbirds fly into the same tree with one, neither party paying any attention to the other. The bold little Sparrow Hawk has no difficulty in driving this larger species, and I have seen a pair of Quail rout a Red-shoulder that had made a sally upon their brood." (Auk, vol. VII, 1890, No. 4, p. 339.)

The following is a summary of Dr. B. H. Warren's investigations: "In my examinations of fifty-seven of these Hawks which have been captured in Pennsylvania, forty-three showed field mice, some few other small quadrupeds, grasshoppers, and insects, mostly beetles; nine revealed frogs and insects; two, small birds, remains of small mammals, and a few beetles; two, snakes and portions of frogs. The gizzard of one bird contained a few hairs of a field mouse and some long black hairs which appeared very much like that of a skunk. The bird on dissection gave a very decided odor of polecat. In two of these Hawks, shot in Florida, I found in one portions of a small catfish, and in the other remains of a small mammal and some few coleopterous insects." (Birds of Pennsylvania, 1888, p. 89.)

To sum up, the food of this Hawk consists of at least 65 per cent of small rodents, which are very injurious to the farmer, and less than 2 per cent of poultry. It seems hardly necessary to more than mention this fact to intelligent persons to convince them of the folly and short-sightedness of destroying this valuable bird, and of the necessity of fostering and protecting it in the farm lands and orchards.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Blarina brevicauda.
Blarina b. carolinensis.
Blarina exilipes.
Evotomys gapperi.
Arvicola riparius.
Arvicola pinetorum.
Mus musculus.
Sitomys americanus.
Didelphis virginianus.
Lepus sylvaticus.
Scalops aquaticus.
Tamias striatus.
Sciurus hudsonicus.
Sorex.
Fiber zibethicus.
Mephitis mephitica.

BIRDS.

Porzana carolina.
Colinus virginianus.
Zenaidura macroura.
Megascops asio.
Colaptes auratus.
Corvus americanus.
Sturnella magna.
Ammodramus s. savanna.
Spizella pusilla.
Junco hyemalis.
Melospiza fasciata.
Passerella iliaca.
Passer domesticus.
Merula migratoria.

The species seems to be rather more hardy than the Red-tail; at least it winters a little farther north, being found more or less commonly as far as parallel 43° at that season. According to Mr. McIlwraith it is not found in Ontario in winter. It breeds throughout the entire range. From New England southward it is the most abundant breeder of any of the rapacious birds, and in Connecticut and the southern portions of New York it is safe to say that its nests outnumber those of all the other birds of prey combined. Usually by the middle of March it begins to build its nest, there being very little difference in the time of commencing between New England and Texas, though Maynard tells us that in Florida it has eggs in February. It breeds a trifle later than the Red-tail, so full complements of eggs are found usually from the middle of April to the first of May. Most collectors give three eggs as the average number for a set, though the writer, from his somewhat limited observations in southern New York, does not remember ever finding less than four, and five was not an uncommon number. Dr. William Wood mentions a set containing six. Incubation, as with most of the other Hawks, occupies less than twenty-eight days.

The nest closely resembles that of the crow, except that it is larger and lacks the compact and neat appearance common to the nest of the latter bird. It is composed of coarse sticks loosely placed together with finer ones toward the central cavity, which is lined with the bark of the grape vine and other fibers, or, in some cases, with pieces of the rough outer bark of the oak and hickory, and not uncommonly, as with many of the other birds of prey, green twigs with the leaves attached are used. Bottom lands grown up with large deciduous trees, or the neighboring hillsides, are the favorite nesting sites of this bird. The nest is placed in one of the larger trees, 40 to 80 feet from the ground, and usually in the fork where the main branches diverge from the trunk. A pair will inhabit the same locality for years, and often occupy a nest for several seasons. The male assists in building and incubating as well as in feeding the young, and, in cases where the female is killed, will rear the brood alone. It is stated that this species remains mated through life, and that even during the winter months mates appear very much attached to each other, differing in this respect from the Red-tail.

Except during the breeding season, when it is confined mostly to the woods, the Red-shouldered Hawk frequents the low lands bordering streams and marshes, and in the winter months one or more are likely to be found where open springs exist, watching for frogs, their favorite food.

Apparently it is less shy than the Red-tail; nevertheless, under ordinary circumstances it will not allow a man on foot to approach within gun range. Like other Hawks, it shows no fear for one on horseback or in a wagon, and in this way can be easily approached.

This Hawk, like most other birds of prey, makes a very interesting pet, and on account of its varied food is easy to keep. The writer once reared, and kept for a year or more, one which was taken from a nest when only a few days old. It finally had to be killed because of its fierceness towards strangers, although it was never vicious towards its owner. When no other person was present it would alight on its owner's shoulder and show signs of contentment and pleasure by uttering a low musical note and by caresses, which consisted in gently passing his ear or a lock of hair between its bill very much as it did its own feathers in the act of pluming itself.

The flight of this Hawk, especially that of the immature birds, is heavy in character and suggests that of the owls.

DESCRIPTION.

Outer web of outer wing feathers distinctly spotted with white, buffy, or yellowish. Shoulders always more or less rusty.

Adult.—Head, neck, and lower parts more or less rusty or cinnamon, transversely spotted or barred with whitish; tail black, crossed by about six bands of white. Above reddish brown, the center of the feathers darker than the edges.

Immature.—Lower parts dull whitish, longitudinally spotted or streaked with dark brown; tail dusky, crossed by numerous narrow bands of dull buffy or grayish brown.

Length: 17.50 to 22 inches (445 to 559$^{\text{mm}}$); extent, 39 to 44 inches (990 to 1117$^{\text{mm}}$); wing, 11.25 to 14.25 inches (285 to 362$^{\text{mm}}$); tail, 8 to 10 inches (203 to 254$^{\text{mm}}$).

Table showing the results of examinations of 220 stomachs of the Red-shouldered Hawk (Buteo lineatus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sing Sing, N. Y.	Oct. 3, 1885		Flicker		Toad, snake, cricket, larva.
Alfred Center, N. Y.	Sept. 11, 1885			Mouse	Grasshopper, larva, spider.
Do.	Sept. 13, 1886			4 shrews	Grasshoppers, spider.
Do.	Sept. 12, 1886				Grasshoppers.
Peterboro, N. Y.	June 25, 1886				Frogs, beetles.
Do.	do			Red-backed mouse, 3 shrews.	
Do.	June 28, 1886			Meadow mouse, 3 shrews.	Beetles, crawfish, spider.
Do.	do			1 shrew	
Do.	July 28, 1886				Insects.
Oneida Lake, N. Y.	Aug. 30, 1886				Squash bug.
Morrisville, N. Y.	Sept. 6, 1886			Meadow mouse, 1 shrew.	10 grasshoppers.
Birmingham, Pa.	Mar. 15, 1886		Feathers		
Chester County, Pa.	Jan. 3, 1886				Cricket, larva, 2 spiders.
East Hartford, Conn.	Dec. 14, 1886			Meadow mouse	Frog.
Gainesville, Fla.	Feb. 28, 1887				Do.
Do.	Mar. 17, 1887				Frog, dragon flies.
Do.	Apr. 7, 1887				Lizard, 2 crickets, larva of beetles.
Do.	Apr. 11, 1887				Snake, insects, earth worm.
Greensboro, Ala.	Nov. 19, 1887				Grasshopper, crickets.
East Hartford, Conn.	Apr. 5, 1887			Shrew	Garter snake, bull-frog.

Table showing the results of examinations of 220 stomachs of the Red-shouldered Hawk (*Buteo lineatus*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
East Hartford, Conn	July 5, 1887			Meadow mouse	Beetle, wasp, larva.
Portland, Conn	Oct. 29, 1887				Leopard frog.
Washington, D. C	Dec. 24, 1887			House mouse, 2 meadow mice.	Crawfish.
Do	do			Meadow mouse, shrew.	Frog, grasshoppers.
Do	Jan. 22, 1888				Empty.
Greensboro, Ala	Feb. 16, 1888				Grasshoppers, beetles.
Locust Grove, N. Y	Aug. 24, 1876				Grasshoppers.
Sing Sing, N. Y	Apr. 8, 1880			Mouse	
Do	May 6, 1880			Meadow mouse, shrew.	2 toads, grasshopper.
Do	Sept. 19, 1882				Toad, larvæ.
Do	Feb. 2, 1884			2 shrews	Frog, salamander.
Do	Feb. 14, 1885			Mole	
Do	Apr. 2, 1885			Meadow mouse, shrew.	
Portland, Conn	Oct. 18, 1886			Mice	
East Hartford, Conn	Oct. 29, 1886			Mole	
Sandy Spring, Md	Jan. 8, 1887			House mouse	
Do	do			2 house mice, white-footed mouse, 1 meadow mouse.	
Do	Jan. 28, 1887			4 meadow mice	
Do	Feb. 11, 1887			Pine mouse, meadow mouse, shrew.	Tree-frog, beetle, spider.
Do	Mar. 8, 1887			House mouse	
Do	do			Mouse	
Do	do			2 meadow mice	
Do	Mar. 24, 1887		Screech-owl	Meadow mouse	
Do	Nov. 26, 1887				Grasshoppers beetles, spider.
Do	Dec. 3, 1887			Meadow mouse	Grasshopper.
Do	do			Pine mouse	
Do	Dec. 9, 1887			Meadow mouse	
Do	Dec. 27, 1887			4 meadow mice	
Do	Jan. 30, 1888			1 mole	
Do	do		Field sparrow		
Do	do		Carolina dove	Meadow mouse	
Chester County, Pa	Nov. 23, 1886			2 meadow mice	Grasshopper.
Do	Jan 20, 1886				Insects.
Do	Apr. 3, 1886			Opossum	Crickets, larvæ.
Do	Nov. 29, 1886			Mouse	
Do	Dec. 1, 1886			Meadow mouse	
Do	Dec. 2, 1886			do	
Do	Dec. 15, 1886			Shrew	
Do	Dec. 16, 1886			Meadow mouse	
Do	Jan. 21, 1886			5 meadow mice	
Do	Jan. 26, 1887			do	
Do	Jan. 28, 1887			Mouse	
Do	Jan., 1887			do	
Do	do			do	
Do	Dec. 18, 1886			Meadow mouse, rabbit.	
Do	Dec. 20, 1886			Meadow mouse	Larva, offal.
Do	Jan. 18, 1887			do	
Do	do				Empty.
Do	Jan., 1887			Meadow mouse	
Do	Feb., 1887			3 meadow mice	
Willistown, Pa	Feb. 20, 1881			Mice	
Do	Mar. 3, 1881			Rabbit	
Pennsylvania	Dec. 20, 1879			Mice	Grasshoppers.
West Chester, Pa	Dec. 9, 1879			do	Do.
West Pikeland, Pa	do				Do.
Westtown, Pa	Feb. 4, 1878			Mice	Do.
Do	Feb. 4, 1879			do	Do.
Willistown, Pa	Jan. 21, 1879				Empty
Volusia County, Fla	Mar. 18, 1886				Catfish.
St. Johns River, Fla	Mar. 14, 1886			Mice	Insects.
Milltown, Pa	Dec. 29, 1884			do	
Thornburg, Pa	Jan. 8, 1885			do	Do.
Westtown, Pa	Jan. 10, 1879			do	
Do	Jan. 28, 1879			do	
Do	Feb. 20, 1879			do	

Table showing the results of examinations of 220 stomachs of the Red-shouldered Hawk (*Buteo lineatus*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Westtown, Pa	Jan. 27, 1879			Mice	Insects.
Do	Feb. 4, 1879			do	
Do	Feb., 1879			do	
Do	Feb., 1878			do	
Willistown, Pa	Apr. 3, 1877			do	
Chester County, Pa	Nov. 30, 1879				Do.
Pennsylvania	Jan. 5, 1881			Mice	
Barton, N. Y	Jan. 1, 1886			3 mice	
Elmira, N. Y	Jan. 21, 1886	Chicken			
Do	Apr. 5, 1886			Field mice	
Do	Aug. 13, 1887			Skunk	
Big Flats, N. Y	Sept. 5, 1887				Grasshoppers, beetles.
Corning, N. Y	Sept. 23, 1887			Field mice	Insects.
Greensboro, Ala	Feb. 25, 1888			Mouse	Lizard, grasshopper, cockroach, 3 crawfish.
Sandy Spring, Md	Mar. 17, 1888			Meadow mouse	
Gainesville, Fla	Jan. 4, 1888				Spider.
Do	Jan. 18, 1888				4 mole crickets, 20 larvæ.
East Hartford, Conn	Sept. 22, 1887				1 frog, 1 garter snake, 1 larva of elm sphinx, 1 larva purslane sphinx, 7 crickets, and other insects.
Do					Frog.
Do	Nov. 1, 1887			Meadow mouse	Frog, lepidopterous larvæ.
Do	Jan. 10, 1888			Shrew	
Stratford, Conn	Oct. 17, 1888			Hair of small mammal.	Frog.
Sandy Spring, Md	Nov. 19, 1888				1 grasshopper.
Fairmont, W. Va	Sept. 21, 1888				Empty.
Cobham, Va	Dec. 1, 1888				46 grasshoppers, 2 crickets, 30 beetles.
Sandy Spring, Md	Dec. 5, 1888				10 grasshoppers.
Do	Dec. 11, 1888			Meadow mouse	10 grasshoppers, 2 crickets, 4 beetles, 2 lepidopterous larvæ.
Do	Dec. 15, 1888			Shrew	
Do	Dec. 21, 1888			House mouse	
Do	Dec. 22, 1888			Pine mouse	Grasshopper.
Do	Dec. 27, 1888			1 meadow mouse, 2 pine mice.	2 beetles, 6 salamanders.
Do	Jan. 4, 1889				White grub.
Do	Jan. 10, 1889			1 shrew	2 beetles.
Do	Jan. 21, 1889		Meadowlark		
Do	Jan. 24, 1889	Quail		Meadow mouse	
Do	Feb. 9, 1889				Empty.
Micco, Brevard Co., Fla.	Dec. 10, 1888		Sora rail, sparrow.		Grasshoppers, snake, turtle.
Hale County, Ala	May 25, 1889	Chicken.			Green snake.
Great Neck, L. I., N. Y.	Apr. 30, 1889				Beetles.
Hale County, Ala	Apr. 10, 1889				20 crickets, 2 grasshoppers, 4 spiders, 1 beetle, 3 lepidopterous larvæ.
Do	Aug. 19, 1889			Mouse	1 cicada, 1 crawfish, 1 lizard.
Owego, Tioga County, N. Y.	Sept. 11, 1889			Chipmunk, shrew.	2 katydids, beetles, 7 sphinx larvæ.
Do	Sept. 10, 1889				Frog, 2 spiders, 1 katydid, 6 grasshoppers, 10 lepidopterous larvæ, beetles.
Do	Aug. 3, 1889				Frog, toad, beetles, and other insects

Table showing the results of examinations of 220 stomachs of the Red-shouldered Hawk (Buteo lineatus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Owego, Tioga County, N. Y.	Sept. 24, 1889			Meadow mouse	1 tree toad, water snake, 2 ribbon snakes, 3 katydids, 4 crickets, 16 grasshoppers.
Greensboro, Ala	Sept. 19, 1889				Sphinx larva.
Do	Sept. 28, 1889				30 crickets, 5 grasshoppers, 1 katydid, sphinx larva, 1 lizard.
Alfred Center, N. Y	Apr. 21, 1889			3 short-tailed shrews.	
Sandy Spring, Md	Nov. 23, 1889			1 pine mouse	
Do	Dec. 5, 1889		Junco, fox sparrow.		Grasshopper.
Do	Dec. 8, 1889			Meadow mouse	
Do	Dec. 13, 1889				3 grasshoppers.
Canton, N. Y	Oct. 26, 1888				Ribbon snake, ring-necked snake.
Kalamazoo, Mich	Apr. 17, 1886				Striped snake.
Newtown, Conn					
Morristown, N. J	Apr. 2, 1886			Meadow mice	Pickerel, snake, 2 frogs.
Schraalenburg, N. J	May, 1882				Snake, toad.
West Farms, N. Y	Sept. 14, 1884				Beetles.
Do	Sept. 22, 1885			Mole	Katydid, spider.
Cincinnati, Ohio	Dec. 4, 1884				Grasshoppers.
Do	Nov. 13, 1884				Do.
Do	Dec. 2, 1884			Mice	Do.
Adams, Ind	Feb. 5, 1887			Rabbit, mouse	
Raleigh, N. C	Sept. 1, 1885				1 toad, 1 spider, 1 mole-cricket, grasshoppers, beetle.
Do	Feb. 23, 1886				Empty.
Do	Mar. 11, 1886			Meadow mouse	Lizard, 2 spiders.
Do	Sept. 17, 1886				Cicada.
Do	Sept. 21, 1887				4 frogs, cicada, katydid, grasshoppers, lepidopterous larvæ.
Do	Feb. 28, 1888			Meadow mouse	
Do	July 18, 1888				Toad, frog, grasshoppers.
Do	Aug. 7, 1888				Frogs.
Rensselaer County, N. Y.	Sept. 23, 1878			Mouse	
Do	Dec. 12, 1878			Mice	
Do	Aug. 20, 1887				Empty.
Do	May 18, 1888			Small mammal	
Troy, N. Y	Oct. 25, 1880			Meadow mouse	
Albany, County, N. Y	Nov. 29, 1880				3 frogs.
Do	Mar. 30, 1883			Mice	Frogs.
Do	Nov. 6, 1888			Small mammal	2 frogs, striped snake, grasshoppers.
Saratoga County, N. Y	Nov. 5, 1888			Mice	
Rensselaer County, N. Y.	May 6, 1889				Frogs, insects.
Hale County, Ala	Nov. 26, 1889			Two house mice	1 mantis, 1 grasshopper.
Sandy Spring, Md	Dec. 27, 1889				Larva.
Do	Jan. 10, 1890				1 cricket.
Do	do				Salamander, 4 larvæ.
Hale County, Ala	Dec. 28, 1889			House mouse	3 grasshoppers, 1 cricket.
Ercildoun, Pa	Feb. 17, 1889				Offal, vegetable matter.
Sandy Spring, Md	Feb. 16, 1890		Robin		5 beetles.
Do	Feb. 21, 1890			2 meadow mice	Spider.
Do	do				2 beetles, 1 grasshopper, 1 spider, 1 larva.

Table showing the results of examinations of 220 stomachs of the Red-shouldered Hawk (Buteo lineatus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Greensboro, Ala	Jan. 28, 1890				Lizard, turtle, beetle, grasshopper, 1 larva.
Morristown, N. J	Feb. 10, 1890			Mouse hair	
Sandy Spring, Md	Mar. 21, 1890			Short-tailed shrew.	Beetle remains.
Do	Sept. 24, 1890				Empty.
Plover Mills, Ontario	June 25, 1883				Crawfish.
Portland, Conn	Sept. 29, 1890				Pickerel.
Do	do				Empty.
Do	Oct. 8, 1890			Short-tailed shrew, 2 meadow mice.	2 frogs, small snake, cricket, larva, grasshopper.
Do	Oct. 11, 1890			Meadow mouse, 3 short-tailed shrews.	2 katydids, 10 tree frogs, 2 dung beetles, 1 beetle, 2 red-backed salamanders.
Do	Oct. 21, 1890				2 leopard frogs.
Sandy Spring, Md	Nov. 9, 1890			Shrew	
Do	Nov. 13, 1890			Red squirrel	Tree frog.
Do	do				Ants, other insects.
Do	Nov. 15, 1890			2 meadow mice	2 mole crickets, 25 grasshoppers, 4 beetles.
Do	Nov. 3, 1890				2 grasshoppers, 1 spider.
Do	Nov. 14, 1890				Grasshopper.
Sandy Spring, Md	Dec. 1, 1890				Empty.
Morristown, N. J	Sept. 11, 1890		Song sparrow		5 crickets, 2 dragon flies, 2 beetles.
Do	Sept. 20, 1890		Small bird		Sphinx larva, beetle.
Horse Hill, N. J	Oct. 29, 1890			1 short-tailed shrew.	1 garter snake.
Morristown, N. J	Nov. 1, 1890			Small shrew.	
Morris Plains, N. J	Nov. 11, 1890				2 frogs.
Do	Nov. 15, 1890				Frog.
Do	do			9 house mice, 1 meadow mouse.	
Do	Nov. 28, 1890			Meadow mouse, muskrat.	
Sandy Spring, Md	Jan. 1, 1891			Short-tailed shrew.	
Do	Jan. 10, 1891				Empty.
Do	do			1 meadow mouse	
Do	Jan. 26, 1891			do	
Do	Dec. 15, 1891			do	
Do	Mar. 15, 1892			Short-tailed shrew.	1 spider, 1 crawfish.
Lancaster County, Pa	Mar. 3, 1892			Meadow mouse	
Farmington, Conn	Oct. 5, 1891			do	1 grasshopper, 1 frog.
Portland, Conn	Apr. 17, 1892				1 frog.
Sandy Spring, Md	Mar. 25, 1892		Crow feathers		May beetle.
Do	Jan. 30, 1892			Meadow mouse	
Do	Jan. 11, 1891				Empty.
Do	do				Do.
Do	do				Do.
Do	Jan. 22, 1892			Meadow mouse, 2 small shrews.	
Do	Jan. 14, 1891			Meadow mouse	
Do	do			do	
Do	Mar. 2, 1892			do	
Do	Mar. 14, 1891			do	Crawfish.
Ponca Agency, Oklahoma.	Aug. 5, 1892				35 grasshoppers, 4 cicadas, beetles.

SUMMARY.—Of 220 stomachs examined, 3 contained poultry; 12, other birds; 102, mice; 40, other mammals; 20, reptiles; 39, batrachians; 92, insects; 16, spiders; 7, crawfish; 1, earthworms; 2, offal; 3 fish; and 14 were empty.

ZONE-TAILED HAWK.

Buteo abbreviatus.

The Zone-tailed Hawk ranges from southern California, Arizona, New Mexico, and Texas south to northern South America. The first specimen taken within our limits was secured by Dr. J. G. Cooper 30 miles north of San Diego, Cal., February 23, 1862.

Little has been written on the food habits of this Hawk. Dr. E. A. Mearns, in his interesting paper on this species in central Arizona at the northern part of its distribution, gives the following: "I frequently observed them throughout the entire year beside the Verde River, where they capture lizards, frogs, fishes, and other desirable articles of raptorial diet." (Auk, vol. III, 1886, p. 66.)

Mr. F. Stephens saw one hover over the water and attempt to catch small minnows. (Bull. Nutt. Ornith. Club, vol. VIII, 1883, p. 30.) It inhabits the country near the base of mountains in the vicinity of streams, and at no season is it found at a great distance from water. It breeds in suitable localities throughout its range. The nest is placed in a cottonwood or other suitable tree, usually in one of the main forks, from 20 to 50 feet from the ground, though sometimes it is saddled on a limb some distance from the trunk. Like other large Hawks, it constructs its nest of sticks, which are loosely put together, and adds a sparse lining of leaves, dry grass, or Spanish moss.

The eggs are deposited early in May, and are usually two in number, though three are occasionally found. Both birds assist in incubation as well as in other duties connected with rearing their young.

DESCRIPTION.

Plumage uniform black or blackish-brown; tail black, crossed by three broad zones, which are ash-gray on outer webs and pure white on nner.

Length: 18.50 to 21.50 inches (470 to 545^{mm}); extent, 49.50 to 53.25 inches (1257 to 1352^{mm}); wing, 15 to 17.40 inches (380 to 442^{mm}); tail, 8.50 to 10.75 inches (216 to 273^{mm}).

Table showing the results of examinations of 5 stomachs of the Zone-tailed Hawk (Buteo abbreviatus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
New River, Ariz	May 16, 1885				Frog, lizards.
Do	do				Frogs, lizards.
Agua Fria, Ariz	May 17, 1885				Tree toads, frog.
Camp Verde, Ariz	May 28, 1884				Empty.
Do	do				Hump-backed sucker.

SUMMARY.—Of 5 stomachs examined, 2 contained reptiles; 3, batrachians; 1, fish; and 1 was empty

WHITE-TAILED HAWK.

Buteo albicaudatus.

This Hawk inhabits the territory from eastern South America north to southern Texas. The first specimen taken within our limits was shot by Mr. G. B. Sennett near Corpus Christi, Tex., March 27, 1878, since which time it has been found not uncommon in the lower Rio Grande Valley. Mr. William Lloyd's records for western Texas in fall and winter undoubtedly refer to the Ferruginous Rough-leg. (Auk, vol. IV, 1887, pp. 188, 189.)

Very little has been written on the food of this Hawk, but presumably it does not differ much from that of the Red-shouldered Hawk. Mr. G. B. Benners says its food consists of snakes, frogs, rabbits, and quails. (Ornithologist and Oologist, vol. XII, 1887, p. 68.)

The White-tailed Hawk breeds along the sand ridges near the coast, and usually places its nest in a Spanish bayonet (yucca) or other low plant from 5 to 10 feet from the ground. The nest is a bulky affair, often several feet in diameter, although the cavity is small, and just sufficient to accommodate the bird. The greater mass of the structure is composed of sticks and coarse herbage, while the lining is made up of dry grass and small fibers. The eggs, which are usually two in number, rarely three or four, are deposited in the early part of May, and the young are found about the 1st of June.

The bird is quite shy and difficult to secure, and when its nest is approached will circle about out of gun range.

DESCRIPTION.

Tail less than half as long as wing. Three outer wing feathers with inner web distinctly cut out. Tail, and the feathers covering it, white, crossed near the end with a broad band of black, in front of which are numerous narrow broken lines of blackish. Above, blueish-gray or slaty; front of shoulders rufous; rump and lower parts white; throat sometimes dusky.

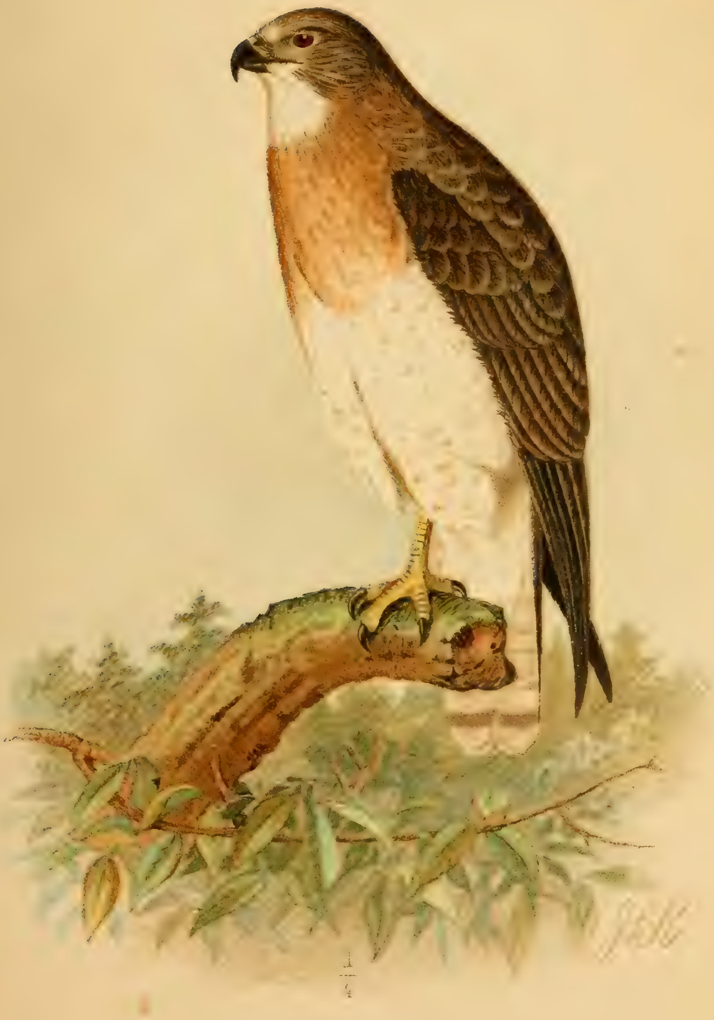
Length: 23 to 24 inches (584 to 609^{mm}); extent, 48 to 54 inches (1220 to 1372^{mm}); wing, 14.50 to 17.75 inches (368 to 450^{mm}); tail, 7.50 to 10.30 inches (190 to 261^{mm}).

SWAINSON'S HAWK.

Buteo swainsoni.

[Plate 9—Adult.]

Swainson's Hawk inhabits western North America, ranging from Alaska and the Mackenzie River district south through middle America and the greater part of South America to the Argentine Republic. In North America it extends east to Hudson Bay, Wisconsin, Illinois,



SWAINSONS HAWK

Buteo swainsoni Bonap.

and Arkansas, and is accidental in New England. Throughout the northern part of its range and as far south as South Dakota and Nebraska it is a migratory species. A few winter near parallel 43°, but the majority pass south of that latitude by the latter part of October and return the following March or early April.

The food of this Hawk, like that of the other *Buteos*, is extremely varied, but generally consists of more insect matter than is usually the case in birds of prey of this group. Besides insects, it feeds extensively on gophers (ground squirrels) and other small rodents, reptiles, batrachians, and occasionally on birds. It very rarely touches poultry, though Mr. H. Nehrling says that in Texas it commits great havoc among this class of birds. (Bull. Nutt. Ornith. Club, vol. VII, 1882, p. 174.) It is probable that this author has been misinformed, as the majority of writers state the contrary. It is quite rare for them to touch small birds, and the following notes will show in what perfect harmony it often lives with other species.

Capt. Charles E. Bendire says: "Lieut. Benson writes me that after the Arkansas king birds (*Tyrannus verticalis* Say) began to build he invariably found one of their nests in any tree that contained a Swainson's hawk's nest. In one case, a pair of these birds had placed their nest directly under and but 8 or 9 inches from that of the hawk. A pair of white-rumped shrikes (*Lanius ludovicianus excubitoroides* Swains.) built also immediately below one of these hawks' nests." (Proc. U. S. Nat. Mus., vol. x, 1887, p. 553.)

Dr. W. J. Hoffman says: "The only nest with eggs observed was one near Antelope Creek [Nevada], which was built near another of *Icterus bullocki.* In this instance both were breeding, and the latter evinced no fear of their neighbors, as one would occasionally fly back and forth from the nest immediately over that occupied by the hawk." (Bull. U. S. Geol. and Geog. Surv. Ter., Hayden, vol. VI, 1881, p. 243.)

Among the smaller mammals, spermophiles form a very important item in the bill of fare, and at certain seasons of the year constitute the greater part of the food of this hawk. The following, from the pen of Mr. H. W. Henshaw, bears on the subject: "Camping here [San Fernando Valley, Cal.] one evening our attention was directed to the great number of gophers (*Spermophilus beecheyi*) which in large colonies inhabited some barren hills near the station. Toward dusk the place was visited by at least a dozen of these birds, which took up their positions on the hillocks thrown up by the animals in front of their burrows, and awaited with patience the moment when a favorable opportunity should occur to snatch a supper. Elsewhere I have frequently seen them thus employed, and their persistence in destroying these pests should entitle them to due consideration at the hands of the farmer. Large number of insects, particularly grasshoppers, are destroyed by these birds, whose abilities as purveyors of food are thus of the lowest order. (Appendix JJ Ann. Rept. of the Chief of Engineers U. S. A. for 1876, pp. 263, 264.)

The following by Mr. Robert Ridgway relates to the food of this hawk in Utah: "We found it [the nest] so filled with the accumulated remains of animals carried to the young that scarcely any depression was noticeable on the top, the decomposing rubbish consisting of bones and other remnants of small hares (*Lepus artemisia*), ground squirrels (*Spermophilus lateralis*, *S. harrisi*, and *Tamias quadrivittatus*), and, strange to say, a full-grown young Sparrow Hawk (*Falco sparverius*). * * * In one of these nests, found July 2, was a single young one, which, although yet covered with snow-white cottony down, was savagely tearing at a dead weasel which had been carried to the nest by the old birds, both of which were killed; * * * the food of this Hawk is by no means confined to small mammals and birds, but during the flights of the grasshoppers, which so often devastate the fields of Utah and other portions of the West, they keep continually gorged on these insects; and at one season we found them living chiefly on the large cricket so common in Salt Lake Valley. On the 31st of May, 1869, at Salt Lake City, we noticed a number of these hawks on the ground, where they remained most of the time quiet, but every now and then they would raise their wings and hop briskly in pursuit of some object, which at the distance, we could not distinguish. Cautiously approaching them, four were shot during the forenoon; they would not allow us to walk to within gunshot, but after flying for a few minutes would sometimes return toward us, and, passing by, give us a fair opportunity for wingshots. Upon dissection, the stomachs of these specimens were found to be filled entirely with the large crickets mentioned above." (U. S. Geol. Explor. of the 40th Paral., King, vol. IV, 1877, pp. 585–587.)

Mr. E. W. Nelson, speaking of the food of this hawk in Alaska, says: "He [Dr. Dall] found the bones of rabbits, squirrels, mice, and ducks, and even part of a whitefish, in the vicinity of their nests, showing that they are ready to prey upon anything that falls in their way." (Rept. Nat. Hist. Collections in Alaska, 1887, p. 142.)

Dr. Coues gives the following information on the food: "The quarry of Swainson's buzzard is of a very humble nature. I never saw one stoop upon a water-fowl or grouse, and though they probably strike rabbits, like the red-tails, their prey is ordinarily nothing larger than gophers. * * * I scarcely think they are smart enough to catch birds very often. I saw one make the attempt on a lark-bunting. * * * But I question whether, after all, insects do not furnish their principal subsistence. Those I shot after midsummer all had their craws stuffed with grasshoppers." (Amer. Nat., vol. VIII, 1874, p. 285, 286.)

The benefit it does to the farmer by destroying vast numbers of gophers probably does not exceed that which it does in clearing his fields of noxious insects, notably grasshoppers and crickets.

Mr. H. W. Henshaw gives the following note in reference to the usefulness of this species: "The crops of all those shot were crammed with grasshoppers; and, as these insects were very abundant, the hawks, as a matter of course, were very fat." (Explor. West of the 100th Merid., Wheeler, vol. v, 1875, p. 422.)

In a communication from Capt. Platte M. Thorne, dated January 3, 1889, from Fort Lyon, Colo., he says: "On July 30, 1887, shot a Swainson's hawk, which seemed too gorged to fly; stomach contained a great number of large grasshoppers. July 31 shot another whose stomach contained part of a gopher and a great many grasshoppers. August 30 saw about thirty Swainson's hawks, which were on the ground and apparently feeding. One shot had about as many grasshoppers in the stomach as would fill a tumbler heaping full."

Mr. Charles F. Morrison, also writing from Colorado, says: "In the fall grasshoppers form the principal diet of this species, although gophers and small birds also are fed upon." (Ornith. and Oologist, vol. XIV, 1889, p. 8.)

Dr. C. Hart Merriam, in the Forest and Stream of December 27, 1888, page 455, gives a very interesting account of a flock of these birds which he saw feeding on grasshoppers in Oregon in the summer of 1888, which is here added: "During the evening of August 20, 1888, Mr. H. W. Henshaw and I drove from Pendleton to the Umatilla Indian Agency, in northeastern Oregon, about 50 miles east of the Great Bend of the Columbia. It had been so hot during the day, the thermometer standing at 104° in the shade, that we were unable to go out. Driving along the crest of the plateau just south of the Umatilla River, at about sundown, we were astonished to see a very large number of large hawks hopping about on the ground, catching grasshoppers. We counted about 150 of these hawks, and there must have been at least 200 in the immediate neighborhood. At first we took them to be roughlegs, but later ascertained that nearly if not all were Swainson's hawks (*Buteo swainsoni*). The period between sundown and dark in that region is so short that the birds were still catching grasshoppers when overtaken by darkness.

"About 6 o'clock the next morning I visited the same place and was gratified to find the hawks engaged in making their breakfast of grasshoppers. They were scattered over a larger area than when we saw them the previous evening. Before 8 o'clock most of them had left the hills and settled down for the day in the poplar trees along the river bottom. Here I found the trees literally full of hawks, and counted as many as thirteen in one tree. Two of the three whose stomachs were examined contained grasshoppers and no other food. The third contained, in addition to grasshoppers, the head of a meadow mouse of the genus *Arvicola* (subgenus *Chilotus*). One contained 88 grasshoppers, another 96, and the third 106. Most of the grasshoppers were a large species of *Œdipoda*, though a few belonged to the genus *Caloptenus*.

"Assuming that each hawk captured 200 grasshoppers a day and that there were 200 hawks, the daily catch would be 40,000 grasshoppers. At this rate these hawks would destroy 280,000 grasshoppers in a week and 1,200,000 in a month. I have no means of knowing how long the hawks remained in the neighborhood of Pendleton, but was told that they had been there before our visit. When in southern California about a month later I was told by Mr. Edward Merriam that on three occasions he had noticed similar gatherings of hawks in San Diego County. Once he saw a flock of several hundred large hawks catching crickets in cracked adobe soil in the San Marcos Valley. At night the hawks came into the live oaks at the head of the valley to rest. He shot one and found its stomach packed full of large black crickets. On two other occasions he saw large flocks of these hawks similarly engaged in catching the same species of crickets. The time was during the latter part of September.

"Mr. Angel, of San Luis Obispo, Cal., told me that he once saw a large number of large dark-colored hawks flying about over the edge of a prairie fire near Chico, in the Sacramento Valley. The air was full of grasshoppers driven out of the grass by the fire, and the hawks were catching and feeding upon them.

"Mr. T. S. Palmer, of Berkeley, Cal., has kindly furnished me with the following interesting communication on a flock of hawks observed by him at Pomona, Cal.: 'While spending the summer of 1887 at Pomona, Los Angeles County, Cal., I was much interested in a "flock" of hawks which remained in the vicinity during the month of August. The fact of their congregating in such numbers may be attributed to two causes: (1) Exceptional abundance of food in a particular spot; and (2) the fact that most of the birds were buteos (*B. swainsoni* predominating) which were migrating slowly southward.

" 'Their favorite resort was a sandy spot a mile east of the town, well out in the middle of the valley and quite a distance from the neighboring mountains. A single irrigating ditch supplied the only water to be had, and to it all the birds in the vicinity were accustomed to resort to drink. Rocky and dry as the spot was, it was sparsely wooded with sycamores and live oaks, and overgrown with white sage, cacti, elderberry bushes, etc. About the first of the month the hawks became common, and although at times scarcely any could be seen, a day or two after they would be present in greater numbers than ever before. On the 22d of August I succeeded in getting quite close to the flocks, and counted fourteen hawks circling about together, much in the manner of turkey buzzards, and not more than 50 or 75 yards from the ground. Nearly all seemed to be young birds, chiefly *Buteo b. calurus* and *Buteo swainsoni*, although there were several which I was unable to identify. All were intently engaged in hunting, and I have little doubt that they were feeding on grasshoppers.

" 'During the month I secured but two specimens. The first taken on the 4th of August, and proved to be a female *Buteo swainsoni* in very dark plumage. Upon dissection the gizzard was found to be tightly packed with grasshoppers, and the bird had no doubt gorged herself, for when I approached the tree in which she was sitting she made no attempt to fly even when I was almost under her. My second specimen, a typical male *Buteo swainsoni*, was taken on the morning of August 31. Both the gizzard and œsophagus were filled with grasshoppers, and out of curiosity I undertook to ascertain their number. I found 110 pairs of the large hind legs, while an assistant counted 133 heads. It is safe to say that this hawk had captured 125 grasshoppers before 9 A. M. If this can be considered as the average number killed per day by each bird, the total number killed by the flock during their stay in the vicinity must have been something incredible.

" 'About the 1st of September the hawks disappeared, and although I visited the place several times during December and January as well as during the summer of 1888, I never saw more than two or three at one time circling about in search of food.' "

Mr. A. S. Bennet, writing to the U. S. Department of Agriculture from Lay, Colo., states that on July 10, 1889, he saw flocks of large hawks, some of which were circling near the ground, while others were perched on it. The mass contained at least 500 individuals, and were feeding upon a species of cricket (*Anabrus purpurascens*), which covered over fully 4 acres of surface. A specimen shot for identification contained six of these insects in its stomach. At the report of the rifle the flocks left the vicinity, but in a short time returned to resume their feast.

From the above testimony it will be seen that Swainson's Hawk, although one of the larger species, is a most beneficial bird, as it destroys immense numbers of noxious mammals and insects and rarely touches poultry or other birds. The services thus rendered should gain for it the good will and protection of all fair-minded farmers and sportsmen, and not the short-sighted prejudice and enmity too commonly shown by these classes of men.

Its breeding range is nearly, if not quite, coincident with its distribution. The situation of the nest is variable. Sometimes it is placed in the tops of large cottonwoods bordering streams; at other times, a few feet from the surface in low trees or bushes on the prairie, while in still other cases it is built on the ground, at the top of some bank or shelf on cliff. The nest is large and slovenly placed together, and in some instances is nothing more than a platform of sticks of various sizes. Usually the nests placed on the ground are less bulky than those in the trees and shrubbery. The cavity is shallow and contains a lining of dry sticks, green leaves, corn husks, or, in the far North, the hair or fur of animals. In some cases, like other Hawks, it occupies the deserted nest of some other bird. The usual number of eggs in a set is two, though three, and occasionally four or five are found. In Texas it commences nest-building in March, while in the northern United States it is the last of April before it begins, and the first of June before the young appear.

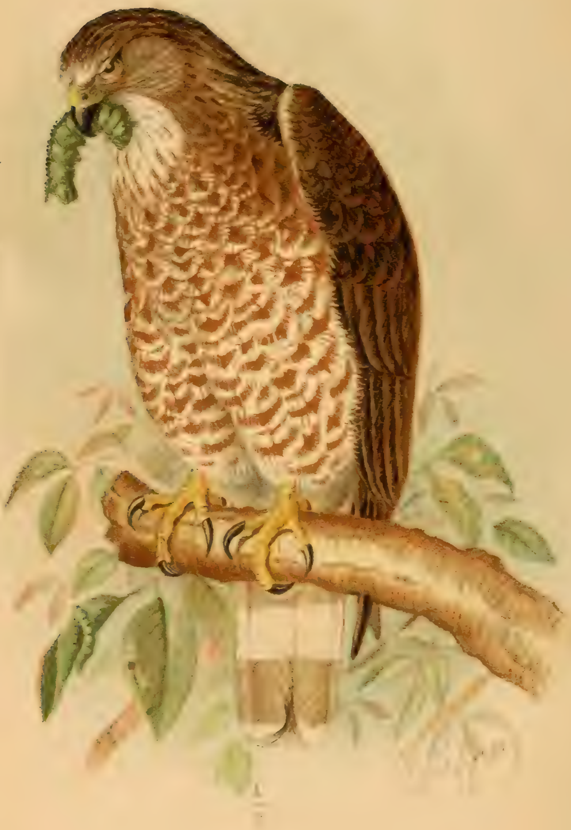
By preference it frequents the timber in the vicinity of streams, though often it is found far out on the prairie, where its only perch is the earth mound of some mammal, or some other slightly elevated knoll. In the fall this species congregates in large flocks, which often number several hundred individuals, and in certain localities where food is abundant they remain together. When the bird first starts from the ground the flight is heavy and clumsy, but in a few moments it becomes easy and graceful and may be long protracted. At times the flocks or even individuals will mount high in air and circle for hours, seemingly for no other purpose than amusement.

When captured young it makes a very interesting pet and soon becomes tame, as the following, from the pen of Mr. Robert Ridgway, testifies: "At our camp in Parley Park we reared four young birds of this species, which were taken from their nests while in the downy state. As they grew up under our care they became very pleasing pets, being exceedingly docile, and much attached to those who fed them. When sufficiently old to use their wings they showed no disposition to leave, although they were allowed full liberty all the while; and though they made frequent tours of inspection over the neighboring meadows, and occasional foraging excursions among the flocks of Blackbirds (*Scolecophagus cyanocephalus*) which frequented the vicinity, they seldom went far away, and always returned after a short absence. They were fed principally upon bits of fresh beef and mutton, varied occasionally by the carcasses of birds we had skinned. Their chief amusement about camp consisted in chasing grasshoppers over the ground, which they pursued by leaping after them, with the wings extended; but when not engaged in this occupation they usually perched quietly upon the fence near by or upon the tents." (U. S. Geol. Explor. of the Fortieth Parallel, King, vol. IV, 1877, p. 587.)

DESCRIPTION.

Only three outer wing feathers, with inner web distinctly cut out. Tail grayish brown, sometimes with a hoary tinge, crossed by a number of narrow dusky bands, which grow less distinct towards base. Above, grayish brown; forehead, chin, and throat, white; upper part of breast, plain rufous, cinnamon, or grayish brown; rest of lower parts, buffy white, sometimes unspotted, but usually more or less barred or spotted with whitish. From the above there are all phases of plumage to a uniform sooty brown.

Length: 19.50 to 22 inches (495 to 559^{mm}); extent, 48 to 56 inches (1220 to 1423^{mm}); wing, 14.50 to 17.25 inches (368 to 438^{mm}); tail, 8 to 10 inches (203 to 254^{mm}).



BROAD-WINGED HAWK

[illegible]

Table showing the results of examinations of eighteen stomachs of Swainson's Hawk (Buteo swainsoni).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Cedar County, Nebr	Aug., 1867			Gopher	68 locusts.
Do	do			do	61 locusts.
Dakota County, Nebr	July, 1868			Rabbit	58 insects.
Sarpy County, Nebr	Sept., 1872			Gopher; mouse.	65 insects.
Salt Lake City, Utah	May 31, 1869				Grasshoppers.
San Francisco Mountain, Arizona.	Aug. 29, 1889				Do.
Camp Verde, Ariz	July 31, 1884			Arizona rabbit	
Do	Aug. 13, 1884			do	
Do	do				Empty.
Do	Aug. 16, 1884				Do.
Do	do				Do.
Do	July 18, 1885				Lizards.
Do	May 1, 1886				Large lizard, horned toads.
Do	Sept. 10, 1886				Grasshoppers, beetles, and frogs.
Do	May 5, 1888				Frog.
Do	May 15, 1888				Large lizards.
Birch Creek, Idaho	Aug. 4, 1890			Short-tailed spermophile.	
Walker Basin, Cal	July 15, 1891				50 grasshoppers.

SUMMARY.—Of 18 stomachs examined, 7 contained small mammals; 8, insects; 3, reptiles; 3, batrachians, and 3 were empty.

COOPER'S BUZZARD.

Buteo cooperi.

The type specimen of this hawk was taken near Mountain View, in the Santa Clara Valley, California, by Dr. Cooper, in November, 1855, and remains unique to this day. Absolutely nothing is known of its life history, and hence no positive information can be given of its food habits. Its size and general make-up prove it to belong to the class of heavy-moving hawks, and it is probable that its food and habits conform in general to theirs.

BROAD-WINGED HAWK.

Buteo latissimus.

[Plate 10—Adult.]

The Broad-winged Hawk inhabits eastern North America from New Brunswick and the Saskatchewan River, ranging south through the United States, east of the Great Plains, to Middle America, West Indies, and northern South America. It migrates in September and October from the region north of latitude 40° and winters from this point southward. In March and early April it again passes north, often in considerable flocks. It breeds throughout the eastern United States as far north as the limit of its range.

The food of this Hawk consists principally of insects, small mammals, reptiles, and batrachians, and occasionally of young or disabled birds. A specimen secured by the writer in May, just after a shower, was gorged with large earth worms. In the spring, when toads frequent ponds to spawn, it devours large numbers of them, and later in the season it is a not uncommon occurrence to see an individual with a frog or snake dangling from its talons.

Mr. Maynard mentions seeing one of these birds attack and kill an adult brown thrush. The writer considers this a very exceptionable event, for from his own observations and those of other ornithologists, it is an undeniable fact that the Broad-winged Hawk rarely attacks birds, and when it does they are generally young just from the nest. In the woods the small birds pay little attention to this Hawk and show no fear in its presence. Mr. James W. Banks found the remains of three unfledged thrushes in the stomach of one killed near St. John, New Brunswick. (Auk, vol. I, 1884, p. 96.)

Among mammals the smaller squirrels and wood mice are most frequently taken, though field mice and shrews also are found in the stomach contents.

During August and September a considerable portion of the food consists of the larvæ of certain large moths which are common at this season, notably those of the elm sphinx (*Ceratomia amyntor*), of the Cecropian moth (*Attacus cecropia*), and of the Polyphemus moth (*Telea polyphemus*), and it is the exception not to find their remains in the stomachs examined. Grasshoppers, crickets, and beetles are also greedily devoured.

The following quotations bear on the subject of this hawk's food:

Audubon says: "In the stomach of this bird I found wood frogs, portions of small snakes, together with feathers, and the hair of several small specimens of quadrupeds." (Ornith. Biography, vol. I, p. 463.)

Mr. J. W. Preston says: "Their food consists of small squirrels, frogs, and, in fact, any small quarry easily captured. Never have I known them to molest the poultry." (Ornith. and Oologist, vol. XIII, 1888, p. 20.)

Mr. J. G. Wells, speaking of the bird in the West Indies, says: "Numerous; feeds on lizards, rats, snakes, young birds, etc., and occasionally makes a raid on the poultry yard." (Proc. U. S. Nat. Mus., vol. IX, 1886, p. 622.)

Dr. F. W. Langdon says: "The stomach of a specimen of this hawk taken at Madisonville in April, 1877, contained the greater part of the skeleton and hair of a small wood mouse (*Arvicola austerus*), a lizard (*Eumeces*) about 6 inches long, and ten or twelve small beetles, with numerous elytra of the same." (Journ. Cincinnati Soc. Nat. Hist., vol. I, p. 116.)

Dr. B. H. Warren gives the following: "In twelve specimens examined by myself, four revealed mice; three, small birds; four, frogs; one, killed the 22d of May, 1882, was gorged with crayfish, with which were traces of coleopterous insects." (Birds of Pennsylvania, 1888, p. 91.)

The only act of the Broad-winged Hawk which seems injurious to agriculture is the killing of toads and small snakes; the former of which are exclusively insect-eaters, the latter very largely so. In one respect its enormous value ranks above all other birds, and that is in the destruction of immense numbers of injurious larvæ of large moths, which most birds are either unable or disinclined to cope with. The good service it does should insure it the protection extended to the other *Buteos*.

The following species of mammals were positively identified among the stomach contents:

Sciurus hudsonicus.
Arvicola riparius.
Arvicola pinetorum.
Scalops aquaticus.
Blarina brevicauda.
Blarina b. carolinensis.
Tamias striatus.
Lepus sylvaticus.
Mus decumanus.

The nest, which is placed in a fork of either an evergreen or deciduous tree, usually is not over 25 feet from the ground, though occasionally it is situated in the tops of the highest trees. Sometimes this hawk appropriates the deserted nests of some other bird, notably that of the crow, or even uses for a foundation the outside canopy of the squirrel. The nest, which averages a little larger than that of the crow, is composed of dead sticks and lined with strips of bark, or with dry or green leaves. The eggs, of which the complement is usually two or three, are deposited from the middle to the latter part of May, consequently this species is among the latest of the hawks to breed. The male assists in incubating the eggs as well as in the duties pertaining to bringing up the young.

Of all our Hawks this species seems to be the most unsuspicious, often allowing a person to approach within a few yards of it, and when started flies but a short distance before it alights again. During the early summer the Broad-winged Hawk often may be seen sitting for hours on the dead top of some high tree. At other times it is found on the smaller trees in the deep woods, along streams, or on the ground, where its food is more often procured. Although sluggish and unusually heavy in its flight, it is capable of rapid motion and sometimes soars high in the air. One of its notes resembles quite closely that of the wood pewee.

DESCRIPTION.

Wing less than 13.50 inches (342$^{\mathrm{mm}}$). Middle toe shorter than naked portion of leg in front.

Adult.—Above dusky brownish, darker on back; below brownish, dull rufous, or rusty, more or less broken by white transverse spotting; lower belly white, barred with dull rufous; tail blackish, crossed by two to four bands of gray or brownish white.

Immature.—Entire underparts dull white or buffy, with longitudinal brown or dusky streaks on breast and sides; tail grayish brown, crossed by five to seven narrow bands of dusky.

Length: 13.25 to 18 inches (336 to 457$^{\mathrm{mm}}$); extent, 33 to 36 inches (838 to 915$^{\mathrm{mm}}$); wing, 9.75 to 11.40 inches (247 to 290$^{\mathrm{mm}}$); tail, 6.50 to 8 inches (165 to 203$^{\mathrm{mm}}$).

Table showing the results of examinations of 65 stomachs of the Broad-winged Hawk (Buteo latissimus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sing Sing, N. Y	Sept. 19, 1885			Chipmunk	Crickets, grasshoppers.
Middle Haddam, Conn.	Sept. 4, 1885				Toad.
London, Canada	Sept. 22, 1883				Toad, large number larvæ.
Lockport, N. Y	Apr. 27, 1886			Meadow mouse	Snake, 2 beetles.
Brooklyn, Ohio	May 10, 1886			Chipmunk, shrew.	
Washington, D. C	June 5, 1887		3 oven birds	2 shrews	
Syracuse, N. Y	Apr. 30, 1887				Toad.
Roan Mountain, N. C	Aug. 10, 1887			Mouse	
Long Island City, N. Y	Sept. 23, 1887				Garter snake, toad, larvæ, beetles.
Do	Sept. 24, 1887				Larva.
Do	do				Quantity of crickets.
Sing Sing, N. Y	Sept. 21, 1881				8 elm sphinx larvæ.
Do	Sept. 23, 1881				Elm sphinx larvæ.
Lake George, N. Y	Aug. 2, 1882				Garter snake.
Sing Sing, N. Y	May 8, 1885				Quantity of earth worms.
Troy, N. Y	Sept. 19, 1885				Tree-frog, grasshoppers.
Sandy Spring, Md	May 10, 1887			Chipmunk, shrew.	
Do	Sept. 1, 1887				Grasshopper.
Chester County, Pa	May 28, 1878				Frog.
Elmira, N. Y	June 27, 1885			Large rat, field mouse.	
Do	Apr. 9, 1886			Weasel	
Do	July 3, 1887		Small bird		
Sandy Spring, Md	Apr. 28, 1888			Pine mouse	
Do	May 29, 1888				Toad.
Do	June 3, 1888			4 shrews	
Buckhannon, W. Va	Aug. 12, 1888				Water snake, 2 cicadas, 1 moth, 1 lepidopterous larva, 1 beetle, 1 spider.
Berwyn, Pa	May 11, 1888				Beetles.
Virginia	Sept, 29, 1889				11 lepidopterous larvæ, 1 white grub, 1 beetle, 1 katy-did, 1 stone cricket.
West Goshen, Pa	Sept. 22, 1886				Crawfish.
Alder Creek, N. Y	Aug. 6, 1886			Meadow mouse.	
Germantown, Pa	Apr. 30, 1885				Garter snake.
Utica, N. Y	Jan. 1885			2 meadow mice.	2 frogs, 2 beetles.
Brookville, Ind	Apr. 19, 1887				Empty.
Decatur County, Ind	Apr. 22, 1887			2 meadow mice, 1 shrew.	1 garter snake, crawfish.
Raleigh, N. C	May 23, 1888			Mouse	
Do	do				Crawfish.
Rensselaer County, N. Y.	Sept. 12, 1887				Empty.
Do	Sept. 13, 1887			Mouse	Frogs, grasshoppers, crickets.
Berkshire County, Mass.	Sept. 14, 1889			Mouse	5 grasshoppers, larvæ, cave cricket, dung beetle.
Huntington, N. Y	Jan. 20, 1890				Empty.
Sandy Spring, Md	July 22. 1890				Empty.
Do	do				2 May beetles.
Do	Aug. 1, 1890				Garter snake, 3 May beetles, 11 larvæ.
Highland Falls, N. Y	May 4, 1874			Hair of mammal	Salamanders, beetles, other insects.
Do	May 3, 1876			Mice, red squirrel	
Do	May 5, 1876				Empty.
Rockland County, N. Y	Aug. 17, 1876				Do.
Highland Falls, N. Y	May 25, 1877				17-year locusts.

Table showing the results of examinations of 65 stomachs of the Broad-winged Hawk (Buteo latissimus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Highland Falls, N. Y.	Aug. 23, 1879				Salamander.
Do	Apr. 25, 1880			Meadow mice, mole.	Small beetles.
Hudson River, N. Y.	Sept. 11, 1880			Short-tailed shrew, meadow mice.	
Highland Falls, N. Y.	do				Beetles.
Do	Apr. 30, 1883				Empty.
Fort Snelling, Minn	May 2, 1889				Red-bellied snake, dragon-fly.
Spring Valley, Penn	Sept. 2, 1890				Salamander, tree frog, crawfish, earth worm, 6 katy-dids, 3 rock crickets, cricket, cicada, squash beetle, 2 other beetles, 19 larvæ.
Do	do				Beetle, cicada, 4 rock crickets, 23 katy-dids, 44 larvæ.
Portland, Conn	May 22, 1890			4 short-tailed shrews.	
Do	Sept. 26, 1890				1 toad, 6 crickets, grasshopper, beetle.
Morristown, N. J	do				3 katy-dids, 3 grasshoppers, 2 larvæ.
Sandy Spring, Md	Apr. 26, 1891			Meadow mouse.	Garter snake.
Do	Nov. 26, 1891			1 short-tailed shrew.	2 caterpillars.
Farmington, Conn	Sept. 25, 1889				1 katy-did, 1 spider, 1 sphinx larva.
Cobham, Va	May 13, 1892				1 blue-tailed lizard, 1 beetle.
Do	do			Young rabbit, 2 short-tailed shrews.	1 blue-tailed lizard.
Sandy Spring, Md	Aug. 20, 1892				34 grasshoppers, 6 cicadas, 1 large walnut moth larva, polyphemus larva.

SUMMARY.—Of 65 stomachs examined, 2 contained small birds; 15, mice; 13, other mammals; 11, reptiles; 13, batrachians; 30, insects; 2, earth worms; 4, crawfish; and 7 were empty.

SHORT-TAILED HAWK.

Buteo brachyurus.

The Short-tailed Hawk, or Little Black Hawk as it is designated in the melanistic phase of plumage, inhabits tropical America, except the West Indies, ranging northward to northern Mexico and Florida. Along the gulf coast of the latter State it is of rare but regular occurrence.

In the spring of 1889 Mr. C. J. Pennock found a pair nesting at St. Marks, Fla., and secured the female, together with one egg. The nest was situated in a pine tree, and consisted of an old nest of a heron remodeled by the addition of a lining of green cypress twigs. The cry which the bird emitted as it circled near the tree resembled somewhat that of the Red-shouldered Hawk. (Auk, VII, 1890, 56.) Mr. W. E. D. Scott secured a pair at Tarpon Springs, Fla., just as they were starting to build a nest. (Auk, VI, 1889, 243.)

There is very little on record regarding the food, habits or, for that matter, the life history in general of this Hawk, which so seldom crosses our southern border. It is not improbable that it resembles the Broad-winged Hawk in habits as well as in the character of its food, though unlike that bird, it is stated to be wary and difficult of approach. In any event, its rarity within our territory precludes its having much economic interest or importance.

DESCRIPTION.

Wing less than 13.50 inches (342^{mm}). Middle toe longer than bare portion of leg in front. Forehead, anterior space in front of the eyes, cheek, and lower parts, pure white; side of chest with patch of rufous or cinnamon. A phase occurs in which the plumage is a uniform sooty-brown or black.

Length: 16 inches, (406^{mm}); wing, 10.50 to 13.10 inches (267 to 332^{mm}); tail, 6 to 8 inches (152 to 203^{mm}).

MEXICAN BLACK HAWK.

Urubitinga anthracina.

The Mexican Black Hawk inhabits tropical America in general, ranging northward as far as central Arizona (Verde Valley) and southern Texas. It is so limited in its distribution within our territory as to warrant brief mention only.

The food of this Hawk consists mostly of the lower forms of vertebrate life and, rarely, of birds. Mr. C. C. Nutting states that it feeds largely upon reptiles. (Proc. U. S. Nat. Mus., vol. V, 1882, p. 404.) Dr. E. A. Mearns, speaking of it in Arizona says: "Occasionally one was seen eating fish upon the sandy margin of the river." (Auk, vol. III, 1886, p. 72.) Mr. Robert Ridgway mentions a specimen which was shot while feeding on a curassow (*Crax*). (Proc. U. S. Nat. Mus., vol. VIII, 1885, p. 581.)

Mr. F. E. Sumichrast, speaking of their food in southwestern Mexico, says: "The kind of food is varied; being naturally voracious, they despise no living prey, and I have taken our of their stomachs small quadrupeds, young birds, reptiles, crustacea, and insects. They are fond of fish, and on the borders of shallow brooks they easily catch the smaller kinds. (Bulletin U. S. Nat. Mus. No. 4., 1876, p. 42.)

Dr. E. A. Mearns states that it migrates from the vicinity of Camp Verde in fall and does not appear again until spring. It breeds to the northern limit of its range. The eggs, usually two in number, are deposited about the first of May, and by the middle of June the young are half grown. The nest is placed in some large cottonwood or other tree near the border of a stream, and is often occupied for several successive seasons. It is a bulky structure, composed of sticks and herbage, lined with dry leaves. This Hawk is most often found among the thick foliage near water courses, where it is observed with difficulty before taking wing, and then is seen for a moment only as it passes through the screen of leaves and branches. Its flight is swift and powerful.

DESCRIPTION.

Uniform black, with a chalky cast in certain lights; tail white at base and tip, and crossed about the middle with a broad white zone; ends of feathers covering base of tail tipped with white; outer wing feathers mottled with rusty.

Length: 21 to 23 inches (533 to 584^{mm}); wing, 13 to 16 inches (330 to 405^{mm}); tail, 7.90 to 11 inches (200 to 280^{mm}).

Table showing the results of examinations of 6 stomachs of the Mexican Black Hawk (Urubitinga anthracina).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Camp Verde, Ariz	Sept. 26, 1884				Frogs.
Fossil Creek, Ariz	June 19, 1885				Indeterminate matter.
Do	do				Do.
Yavapai County, Ariz.	June 30, 1886				Fishes and frogs.
Do	May 20, 1887				Snake.
Do	May 21, 1887				Frogs and fish.

SUMMARY.—Of 6 stomachs examined, 3 contained batrachians; 2, fish; 1, reptile, and 2 indeterminate matter.

MEXICAN GOSHAWK.

Asturina plagiata.

The Mexican Goshawk is distributed through the country from the Isthmus of Panama northward to the southern parts of Arizona and New Mexico. It is a common summer resident in the vicinity of Tucson, among the mesquit groves, but leaves for its winter home in October.

This Hawk feeds on small reptiles, ground squirrels, mice, insects, and birds. Capt. Charles E. Bendire, speaking of the food, says: "It is stated that this hawk feeds principally on lizards, but although the latter are exceedingly plentiful throughout southern Arizona, I am satisfied that small birds form no inconsiderable portion of its food." (Ornithologist and Oologist, vol. VI, 1882, p. 88.) Mr. William Brewster, speaking of the food of birds captured in the vicinity of Tucson, says: "The stomachs of the specimens examined contained lizards, small squirrels, fish scales, the wing covers of beetles, and unrecognizable fur and bones of small rodents." (Bull. Nutt. Ornith. Club, vol. VIII, 1883, p. 31.)

In the vicinity of Tucson the eggs are deposited about the middle of May, though nests in which the eggs were only partially incubated have been found as late as June 15. The usual complement of eggs is two, though three are not uncommon. The nest is placed in the tops of high trees, often 50 to 75 feet from the ground. According to Capt. Charles E. Bendire, it is composed of the fresh twigs of the cottonwood, with some of the leaves attached. He has observed the birds breaking off the branches with their talons as they pass rapidly by the tree. In some cases the lining of the nest is composed of dry leaves of the cottonwood, while in others the strips of bark are also used.

This hawk frequents the more open groves and the borders of timber, and usually is not shy or difficult to approach. The flight is swift and falcon-like. Capt. Bendire states that its note resembles very closely that of the long-billed curlew and at first he mistook it for that of the latter bird.

The Mexican Goshawk, like a number of other tropical species which cross the southern border, is of very little economic importance in the present connection on account of its limited distribution in our territory.

DESCRIPTION.

Above deep ash gray; top of head and back of neck with five blackish shaft streaks; tail black, tipped with white, and crossed by two or three narrow bands of white; feathers covering base of tail white; below white, very regularly barred with ashy, the stripes being farther apart on flanks and belly.

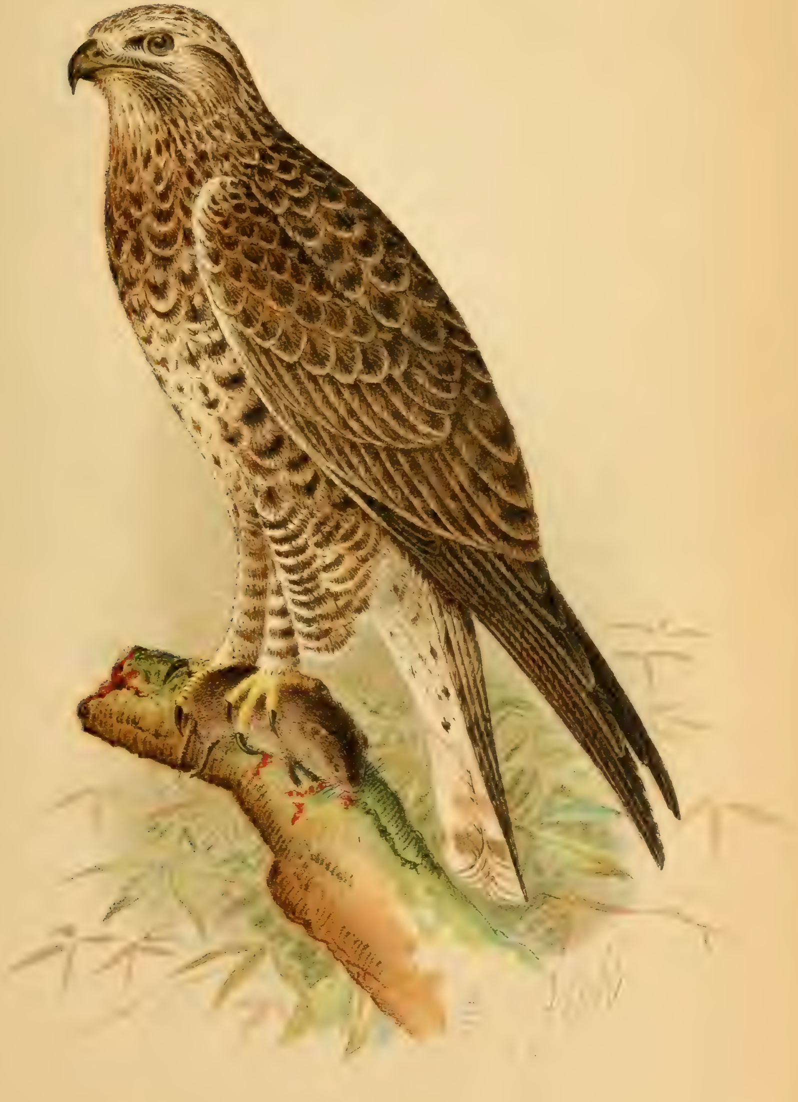
Length: 16 to 18 inches (406 to 457^{mm}); wing, 9.50 to 11.70 inches (242 to 297^{mm}); tail, 6.70 to 8.20 inches (170 to 208^{mm}).

ROUGH-LEGGED HAWK.

Archibuteo lagopus sancti-johannis.

[Plate 11—Adult.]

The Rough-legged Hawk inhabits, during the different portions of the year, the greater part of North America north of Mexico, but in summer is found north of the United States only. In the West it extends far south in winter, occurring not uncommonly in suitable localities in Kansas, New Mexico, Arizona, and southern California. In the east its winter range is more restricted, and the species may be considered rare or of casual occurrence south of the Potomac River. The limit of its northern range in winter depends much more upon the presence or absence of snow than upon temperature. It retreats and advances from one feeding ground to another as the snow comes and goes, keeping just south of the snow belt. In average winters it is found through southern New England, southern New York, Illinois,



AMERICAN [illegible] HAWK

Missouri, and Nebraska, and on the Pacific coast as far north as Washington. Generally it is common as late as November and as early as April in the southern portions of the northern tier of States.

The Rough-leg is one of the most nocturnal of our hawks, and may be seen in the fading twilight watching from some low perch, or beating with measured, noiseless flight, over its hunting ground. It follows two very different methods in securing its food, one by sitting on some stub or low tree and watching the ground for the appearance of its prey, as the Red-tail does; the other by beating back and forth just above the tops of the grass or bushes, and dropping upon its victim, after the manner of the Marsh Hawk. Its food consists principally, if not almost exclusively, of the smaller rodents, and most prominent among these are the arvicoline mice and lemmings. As is well known, the meadow mice (*Arvicolæ*) are widely distributed over the north temperate zone, and often occur in immense numbers, overrunning certain sections of country, and doing irreparable damage to crops as well as to fruit and ornamental trees. Repeatedly young orchards, consisting of hundreds of trees, and representing great money value, have been totally destroyed by these pests. The damage is done in winter, under the snow, where the mice eat the bark from the trees, often completely girdling them and causing their death. Usually meadow mice are fairly common if not abundant over a large part of the meadow and marsh lands of the central and northern United States and temperate Canada. To show how important meadow mice are to the Rough-leg as an article of food, it may be stated in general terms that the southern limit of its wandering in winter is nearly coincident with the southern boundary of the region inhabited by meadow mice. In the north lemmings are abundant over the country in which the Rough-leg makes its summer home, and furnish a never-failing supply of food for old and young.

The following statements indicate to what extent the Rough-leg feeds on meadow mice: Mr. E. O. Damon, of Northampton, Mass., informs the writer that he has killed hundreds of these hawks on the low meadows bordering the Connecticut River, and of the many stomachs he examined all contained the remains of meadow mice. He further states that he never found even a frog in its stomach or saw it attack anything larger than a rat or meadow mouse. Dr. Michener (in U. S. Agr. Rept., 1863, p. 291) says of the Rough-leg: "The number of meadow mice which this species destroys ought, one would think, to insure it the protection of every husbandman." Dr. J. C. Merrill states that the stomachs of those killed at Fort Klamath, Oregon, usually contained field mice. (Auk, vol. v, p. 145.) Mr. A. Hall, writing of this hawk in Nebraska, says: "This species is very abundant in winter, and subsists entirely upon mice, frogs, and small rodents. It seldom if ever preys upon birds." (Forest and Stream, vol. xx, May 10, 1883, p. 284.)

Mr. H. W. Henshaw gives the following relative to the food of this species: "Utah Lake and the surrounding marshes attract multitudes of water fowl; and this undoubtedly explains in part the abundance of hawks at this season, since wounded and disabled ducks must form no inconsiderable part of their food. In its manner of hunting it much resembles the foregoing species [Squirrel Hawk], and it subsists to a great extent upon mice, which are very numerous in the rushes. In the stomachs of every individual captured [eleven in number] were found the remains of these little animals." (Explor. West of the 100th Merid., Wheeler, vol. v, 1875, p. 426.)

The examination of such a considerable number of specimens from a locality in which multitudes of ducks occur, and the finding of nothing but the remains of mice is quite conclusive evidence that the former is not their favorite food. Recently Mr. Henshaw informed the writer that the above statement relative to this hawk feeding on water fowl was based on reports of gunners, which he now believes to be incorrect. Besides lemmings and meadow mice the Rough-leg feeds at times quite extensively on other species of mice, ground squirrels, moles, shrews, and even rabbits. Capt. Bendire states that while it remains at Camp Harney, Oregon, its principal food consists of cotton-tail rabbits.

Among the earlier writers, Wilson gives the following about its food: "This handsome species notwithstanding its formidable size and appearance, spends the chief part of the winter among our low swamps and meadows, watching for mice, frogs, lame ducks, and other inglorious game." Audubon says: "It feeds principally on moles, mice, and other small quadrupeds, and never attacks ducks on the wing, although now and then it pursues a wounded one." Nuttall gives mice, moles, and frogs as its food and quotes Pennant as authority for the statement that it feeds on ducks.

We find very little information as to whether the Rough-leg feeds extensively on insects, or of the kinds which it devours. Prof. Samuel Aughey found the remains of seventy insects besides other food in the stomach of a specimen shot in Nebraska in September. It is presumable that like the *Buteos* it at times feeds extensively on grasshoppers, crickets, and beetles. It is credited with feeding on snakes, lizards, frogs, and toads, though the writer has never found the remains of any of these animals in the stomachs examined, and finds but a few general remarks on the subject in the books.

Although one of the largest hawks, the Rough-leg is undoubtedly one of the most harmless, so far as molesting poultry and game is concerned. Pennant is chiefly accountable for any prejudice that may be felt against the bird, for he asserted that it fed largely on ducks, and remarked that it "sits on a rock and watching their rising, when it instantly strikes at them." This statement has been copied by various authors, especially the earlier ones, until now there are many people who really believe it. The writer has yet to meet anyone who has seen it attack water fowl, or in fact any other bird. Among those questioned on the subject are a number of eminent ornithologists, some of whom have published the statement that the Rough-leg feeds on wounded ducks. The error arose from their taking information second-hand from gunners who probably mistook either the Duck Hawk or Prairie Falcon for the bird under consideration When hard pressed by hunger it may feed on dead water fowl as well as the carcasses of other animals.

Those Hawks that remain farthest north in winter are more often forced by circumstances to feed on refuse. Maynard says that in Massachusetts they feed upon fish and the dead animals cast up by the sea, and Mr. Vernon Bailey, writing from Elk River, Minnesota, says: "A few years ago, probably in 1883, I was trapping for muskrats and minks late in the fall. As the place was over a mile from home, and I was catching a good many rats, I skinned them and left the carcasses where caught. Soon I noticed that these were often eaten or gone. Rough-legged Hawks were unusually numerous that fall, and stayed nearly all winter. One morning I came suddenly to the top of a hill and saw a hawk fly away from a half-eaten rat on the other side. It was promptly shot, and proved to be a fine dark Rough-leg. This was the only time that I caught the hawk in the act, but from the manner in which the rats were eaten, the number of hawks present, and after snow came the tracks seen around the remains of the rats, I had no doubt that the hawks had eaten them."

The few specimens which have been secured in summer south of the northern boundary of the United States are those which have failed to migrate, presumably on account of disease or from inability or indisposition to make long flights after the receipt and healing of gunshot wounds. In all these cases the genitalia are undeveloped. The nest and eggs mentioned in the History of North American Birds as coming from Wiscasset, Me., near the mouth of the Kennebec River, if not an error in identification, is probably the only record of the breeding of this species in eastern United States. Dr. Warren informs the writer that the instance mentioned in his "Birds of Pennsylvania" of the Rough-leg breeding in Pennsylvania was a case of misidentification. Dr. G. S. Agersborg gives it as breeding once in southeastern Dakota (Auk, vol. II, p. 285), but does not inform us whether it was found nesting or merely that the presence of the bird in summer was taken as evidence.

It breeds sparingly in Labrador and the southern portions of Canada west of Manitoba. In the vicinity of Winnipeg, Seton gives it as a migrant only. (Auk, vol. III, 1886, p. 154.) Farther north, even far within the Arctic circle, it is an abundant breeder. Although common in the Hudson Bay and Anderson River regions in northern Alaska, the Old World form seems to replace it not only on the seacoast, but along the entire length of the Yukon.

The nesting site is more or less varied, most of the nests being placed in trees, while others are situated on rocky ledges or on top of shaly cliffs. Out of the fifty-eight nests found by Mr. MacFarlane forty-six were placed in trees, while the remaining twelve were built along the edge of steep cliffs. Those in the former site were found usually in pines [spruces] and were built in a crotch near the top. The nest is formed of dry sticks and small twigs, lined with fine grass and feathers. It is stated that those built on cliffs usually contain more soft material for lining, giving them a compact appearance. The eggs in a set vary from three to five in number. They are deposited as early as the middle of May, and in the higher latitudes fresh eggs have been secured as late as the last of June.

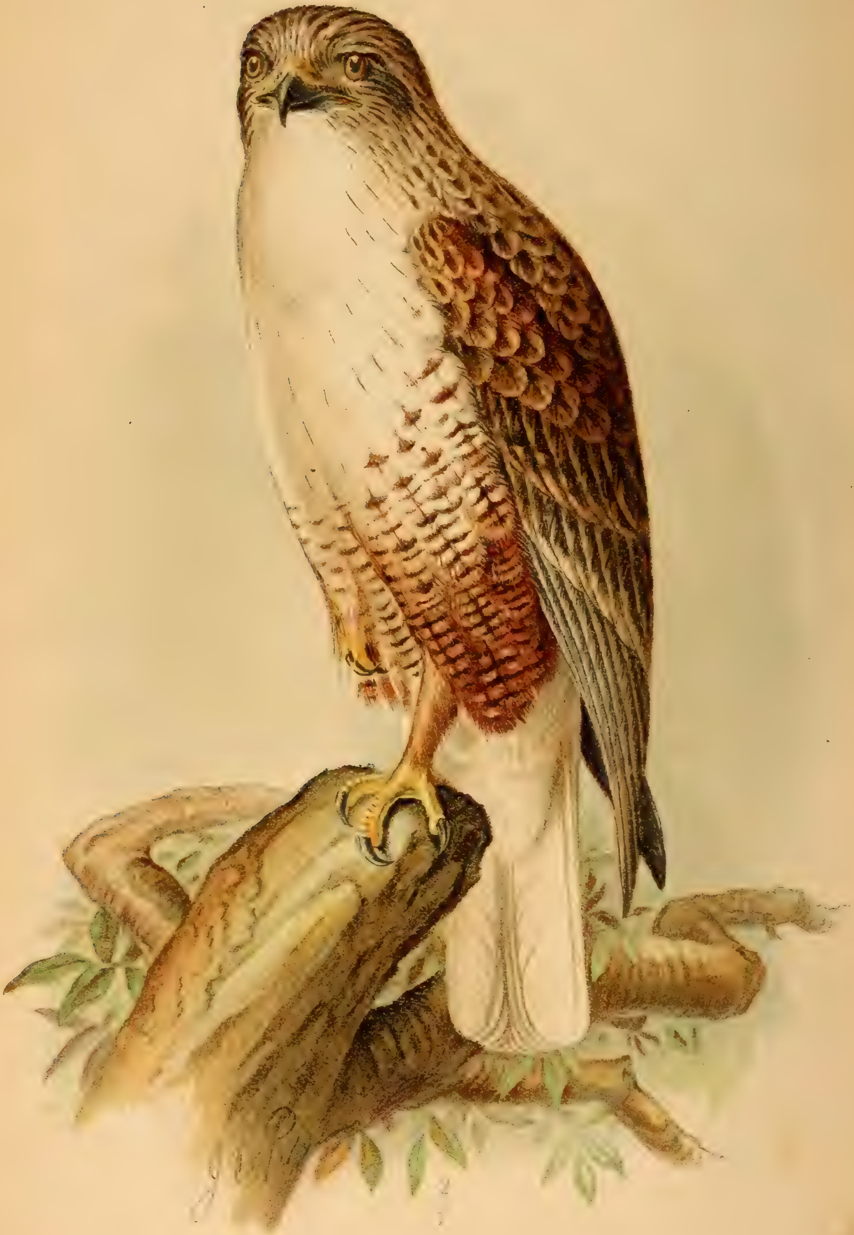
The Rough-legged Hawk is one of the largest, as well as one of the most striking of American Hawks. It is mild and gentle in disposition, and even when adult may be tamed in the course of a few days so that it will take food from the hand and allow its head and back to be stroked. When caged with other species of hawks it does not as a rule fight for the food, but waits until the others have finished, before it begins to eat. The most wonderful exception to this, however, and one hard to credit, is related by Mr. E. W. Nelson, as follows: "A friend of the writer's, living on a farm in Northeastern Illinois amused himself one spring by trapping various birds of prey as they passed north, using his empty corncrib as a bird-house. Into this, in rapid succession, were introduced Red-tailed, Sharp-shinned, Cooper's, Broad-winged, and Rough-legged Hawks, with a single Horned Owl. As might be expected, the family was by no means a happy one, and as my friend failed to provide a sufficient supply of food, the owl made use of his fellow prisoners, and in a very few days the owl and a black Rough-legged Hawk—the handsomest specimen I ever saw—were the only occupants of the crib. The next act in the tragedy closed with the Rough-legged Hawk perching quietly in his usual corner, while the badly used-up form of *Bubo* lay among the bones of its victims." (Report Nat. Hist. Collections in Alaska, 1887 p. 143.)

The flight of the Rough-leg is seldom rapid and often appears labored and when on the wing, this hawk resembles the Osprey more than any other bird of prey.

DESCRIPTION.

Legs densely feathered in front and on sides down to base of toes. Width of bill at corners of mouth 1.35 to 1.45 inches (33 to 36^{mm}). Head and neck whitish, streaked with dusky. Above, irregularly varied with white, grayish, dusky, or rusty; base of tail and feathers covering its upper surface, white; broad band near end of tail, grayish or dusky. Below, whitish, usually with a band of dusky across front. Specimens are sometimes nearly uniform black.

Length: 19.50 to 23.50 inches (495 to 597^{mm}); extent, 50 to 54 inches (1270 to 1370^{mm}); wing, 15.75 to 18 inches (400 to 457^{mm}); tail, 9 to 11 inches (228 to 280^{mm}).



FERRUGINOUS ROUGH-LEG

Archibuteo ferrugineus.

Table showing the results of examinations of 49 stomachs of the Rough-legged Hawk (Archibuteo lagopus sancti-johannis).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Dec. 9, 1886			Small short-tailed shrew.	
Do	Feb., 1887			Meadow mouse	
Do	Jan. 28, 1879			Mice	
Do	do			do	
Do	Dec. 27, 1878			do	
Do	Apr., 1876			do	
Do	Mar. 20, 1880			do	
Beatrice, Nebr	Sept., 1872			Gopher	Lizard; 70 insects
Elmira, N. Y	Nov. 5, 1887			Rabbit	
Do	Jan. 3, 1888			Weasel	
Sandy Spring, Md	Mar. 17, 1888			2 meadow mice	
South Windsor, Conn	Mar. 29, 1887			Meadow mouse	
Portland, Conn	Mar. 30, 1887			6 meadow mice	
Northampton, Mass	Nov. 30, 1887			5 meadow mice	
Do	Dec. 2, 1887			Meadow mouse, house mouse.	
Do	Dec. 14, 1887			6 meadow mice	
Do	Dec. 20, 1887			3 house mice	
Do	Nov. 26, 1886			Meadow mice	
Do	Nov. 27, 1886			do	
Do	Dec., 1886			do	
Do	Feb. 23, 1887			2 meadow mice	
Do	Feb. 16, 1887			7 meadow mice	
Do	Apr. 9, 1888			do	
Do	Apr. 14, 1888			8 meadow mice	
Do	do			2 meadow mice	
Do	Apr. 15, 1888				Empty.
Do	do			2 meadow mice	
Do	do			3 meadow mice	
Adams, Decatur County, Ind.	Jan. 15, 1887			3 white-footed mice.	
Tracy Station, Ind	Feb. 12, 1887				Do.
Do	do			Rabbit	
Do	do				Do.
Springfield, Ind	Mar. 21, 1887			White-footed mouse.	
Decatur County, Ind	Mar. 22, 1887			3 mice	
Rensselaer County, N. Y.	Feb. 15, 1880			Meadow mice	
Northampton, Mass	Apr. 1, 1887			Mice	
Cincinnati, Ohio	Jan. 27, 1885			4 meadow mice	
Do	do			Mice	
Amagansett, Long Island.	Feb. 24, 1884			Meadow mice	
Suffolk County, N. Y	Nov. 22, 1884			4 meadow mice	
Jackson County, Mo	Dec. 22, 1883			Meadow mice	
Do	do			do	
Amagansett, N. Y	Mar. , 1886			Mice	
Albany County, N. Y	Oct. 29, 1888			2 meadow mice	
East Hartford, Conn	Feb. 9, 1887			Meadow mouse	
Orange County, N. Y	Jan. 9, 1884				Do.
Lancaster County, Pa	Feb. 23, 1892			1 meadow mouse.	
Do	Mar. 8, 1892			2 meadow mice	
Do	do			4 meadow mice	

SUMMARY.—Of 49 stomachs examined, 40 contained mice; 5, other mammals; 1, lizards; 1, insects; and 4 were empty.

FERRUGINOUS ROUGH-LEG.

Archibuteo ferrugineus.

[Plate 12—Adult.]

The Ferruginous Rough-leg, or Squirrel Hawk, inhabits the western United States ranging to the eastern border of the Great Plains, north to the Saskatchewan River, and south into Mexico. It migrates from the northern part of its range before the advent of cold weather. It breeds regularly from Colorado, Kansas, and Nebraska northward; south of this region there seems to be no positive record of its nesting.

The food of this Hawk consists almost exclusively of small mammals and reptiles, and, like the Rough-leg, never attacks birds. Dr. J. G. Cooper, as quoted in History of North American Birds (vol. III, p. 303), says: "It rarely, if ever, attacks poultry, and limits its prey to wild animals, and is therefore a decided friend to the farmer."

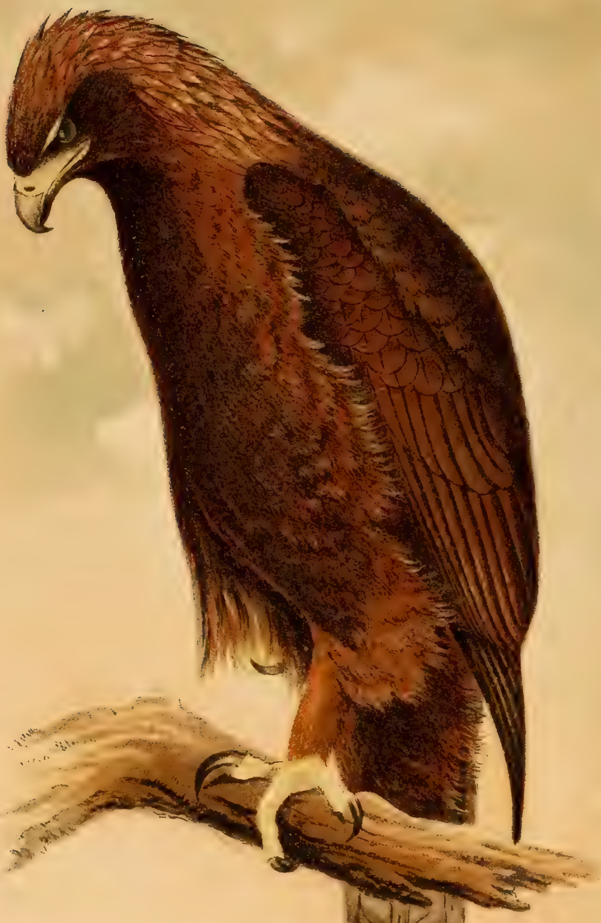
Mr. H. W. Henshaw says of its food: "Their prey consists principally of the small mammals—mice and ground squirrels—to secure which they fly a few feet from the ground." (Explor. West of the 100th Merid., Wheeler, vol. V, 1875, p. 425.)

Dr. Coues gives the following: "In the stomachs of those examined I found the remains of burrowing pouched rats (*Thomomys fulvus*, Woodh.), the western wood mouse (*Hesperomys leucopus* var. *sonoriensis*), kangaroo-mice (*Dipodomys ordii*), and some *Arvicolæ* I could not identify. I was never before aware of the latter in this locality [Ft. Whipple, Ariz.], and would remark, in passing, how often small mammals, reptiles, and insects, which might long remain undetected, owing to their rarity or insignificance, are found in the stomachs of rapacious birds. * * * This bird is known as the 'California Squirrel Hawk' in some localities, but it is not to be inferred that they often capture the agile arboreal *Sciuri*. The name is gained from their feeding extensively, in California, upon the 'ground squirrels' (*Spermophilus beecheyi*), which abound in many parts of that State. The Hawks are almost always, too, observed in the vicinity of the settlements of the *Spermophili*, standing on the ground where there are no trees, or flying low over the surface, in either case on the alert to seize any unlucky animal that may venture too far from home." (Birds of the Northwest, 1874, p. 366.)

Thus it will be seen that this species is harmless and very beneficial and hence should be protected by all agriculturists throughout the country it inhabits.

The nest is usually built in a tree at no great distance above the ground, but when trees are not available it is placed on the shelves of some of the earth cliffs which abound in certain parts of the West. Like that of the other larger hawks, it is composed of good-sized sticks and coarse herbage of one kind or another, and is lined with softer material than the bulk of the structure is composed of. When such things existed on the plains, the ribs and smaller bones of the buffalo were used in the construction of the nest, often forming a large part of it. The eggs, which are usually three or four in number, are deposited early in May, and by the middle of July the young are ready to leave the nest.

The Squirrel Hawk is preëminently a bird of the prairie, and, unlike the common Rough-leg, shows little partiality to the vicinity of water, though in other respects it closely resembles the latter bird in habits. When this hawk is hunting its flight appears labored and heavy, but



GOLDEN EAGLE

when circling high in the air its flight is graceful and resembles closely that of the Golden Eagle. In fact, in parts of the West it is known by the name Eagle.

DESCRIPTION.

Legs densely feathered in front and on sides down to base of toes. Width of bill at corners, 1.70 to 1.90 inches (42 to 48^{mm}). Upper parts, generally, and thighs rusty; the former streaked longitudinally and the latter transversely; tail white, washed with ashy gray or rusty; lower parts pure white.

Length: 22.50 to 25 inches (572 to 635^{mm}); extent, 54 to 56.50 inches (1370 to 1435^{mm}); wing, 15.90 to 18.80 inches (404 to 477^{mm}); tail, 9.50 to 11 inches (242 to 280^{mm}).

Table showing the results of an examination of 1 stomach of the Squirrel Hawk (Archibuteo ferrugineus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Camp Verde, Ariz.....	Dec. 21, 1886	....	....	Arizona rabbit..	

GOLDEN EAGLE.

Aquila chrysaëtos.

[Plate 13—Adult.]

The Golden Eagle inhabits the northern portions of the northern hemisphere ranging south in North America to southern California, Arizona, New Mexico, Texas, and Georgia. It seems to be nowhere a common species in the East, but it is much more numerous in the mountainous parts of the far West. It is confined chiefly to the mountains and more northern latitudes, where it breeds. It is able to endure intense cold, and sometimes remains far north in winter. In fact, its movements at that season are more in the form of wandering for food than regular migration to the south.

The food consists mainly of mammals and birds, of which spermophiles, rabbits, fawns, lambs, turkeys, grouse, water fowl and other large birds form the principal part, though offal and carrion are sometimes taken.

Audubon speaks of the food as follows: "Young fawns, raccoons, hares, wild turkeys and other large birds are their usual food, and they devour putrid flesh only when hard pressed." (Ornith. Biography, vol. II, p. 467.) In the north, Mr. MacFarlane states that they feed on ducks, mice, and other small animals, partridges, and the fawn of the reindeer. (Hist. North Am. Birds, vol. III, p. 318.)

Capt. Charles E. Bendire, speaking of them in Oregon, says: "They are generally seen hunting in pairs in the early spring, chasing ducks, geese, and sage hens, and mostly successfully. I came within a few feet of one gorging itself on a yellow-footed marmot [*Arctomys*] it had just captured." (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 137.)

Dr. E. A. Mearns, U. S. Army, in a note on the Golden Eagle, says: "Several years ago a Golden Eagle was shot opposite those cliffs by a farmer at Cold Spring [New York] while in the act of destroying a goose belonging to the farmer." (Bull. Nutt. Ornith. Club, vol. III, 1878, p. 100.)

Mr. George A. Boardman captured a Golden Eagle under the following circumstances: "When out snipe shooting October 16 (1880), a big Blue Heron flew up and almost immediately dropped to the ground. Instantly a large bird came like a meteor and struck the Heron with full force, and in their excitement I got a fine specimen of the Golden Eagle." (Bull. Nutt. Ornith. Club, vol. VI, 1881, p. 58.)

Although this eagle usually attacks quarry which is easy to secure, Mr. Robert Ridgway shows that it is capable of capturing agile game: "At Camp 19, on the last-named mountains, [East Humboldt, Nev.,] on the 29th of July, we were so fortunate as to witness the chase and capture of a Sage-Hen (*Centrocercus urophasianus*) by a pair of these Eagles. We were standing a few yards in the rear of a tent when our attention was arrested by a rushing noise, and upon looking up the slope of the mountain we saw flying down its wooded side with the rapidity of an arrow a Sage-Hen pursued by two Eagles. The Hen was about 20 yards in advance of her pursuers, exerting herself to the utmost to escape; her wings, from their rapid motion, being scarcely visible. The Eagles in hot pursuit (the larger of the two leading), followed every undulation of the fugitive's course, steadily lessening the distance between them and the object of their pursuit; their wings not moving, except when a slight inclination was necessary to enable them to follow a curve in the course of the fugitive. So intent were they in the chase that they passed within 20 yards of us. They had scarcely gone by, however, when the Sage Hen, wearied by her continued exertion, and hoping, probably, to conceal herself among the bushes, dropped to the ground; but no sooner had she touched it than she was immediately snatched up by the foremost of her relentless pursuers, who, not stopping in its flight, bore the prize rapidly toward the rocky summits of the higher peaks, accompanied by its mate." (U. S. Geol. Expl. of the Fortieth Parallel, King, vol. IV, 1877, p. 591.)

Numerous sensational stories have appeared from time to time relating to the carrying off of children by Eagles, the great majority of which have originated in the fertile brains of their versatile reporters. There is little doubt that if a hungry Eagle found a young baby unprotected it would carry it off. The statements that babies have been carried away by Eagles and later recovered from the nest uninjured are as ridiculous as they are untrue.

Birds of prey always strike their talons deeply into their quarry before carrying it off, unless they are interrupted at the moment they strike. It is possible that some of the stories found in the older books, especially those relating to Europe, may be true, but we know of no authentic instance within the past fifty years of Eagles attacking children. Occasionally when this bird is interrupted while feeding it will attack even a man, as the following from Mr. E. W. Nelson shows: "On one occasion a pair was disturbed by a friend of mine while they were feeding upon the remains of a hog in northern Illinois. As my friend approached the birds arose and swooped fiercely at him. Both birds were shot almost at the muzzle of the gun; the first fell dead almost at his feet, but this apparently seemed only to increase the rage of the survivor, which renewed the attack until it, too, was disabled." (Nat. Hist. Coll., Alaska, 1887, p. 144.)

At certain seasons of the year or in sections where its natural food, wild game, is scarce this bird often becomes very troublesome by attacking the young of domesticated animals. Mr. Oliver Davie speaks of one of these Eagles which was killed near Columbus, Ohio, December 13, 1881. It was alleged that it had killed several young calves, and he ascertained that the bird had been observed feeding upon two of them, but it was not seen in the act of killing them. (Bull. Nutt. Ornith. Club, vol. VII, 1882, p. 123.)

The following letter to Col. Alexander Macbeth, of Georgetown, S. C., shows how destructive Eagles may occasionally become, but may refer in part to the Bald Eagle:

RHEMS, GEORGETOWN COUNTY, S. C.,
May 30, 1889.

DEAR SIR: Yours, 22d instant, at hand, and in reply will say that the eagles are more destructive to the sheep-growing industry in this section than dogs. On one ranch this spring one shepherd alone killed over forty himself, principally by using strychnine. They were worse than we ever knew of before. We lost fully 400 or 500 lambs, as they devour them as fast as they drop from the old sheep. * * * We frequently see during eagle or lambing season, fifteen to twenty eagles in a covey (or bunch), which shows at a glance that they are destructive. We have also a few wildcats that devour the young sheep, but can manage them better than eagles.

Yours very truly.

T. RHEM AND SONS.

MR. ALEX. MACBETH,
Georgetown, S. C.

Mr. Henry Seebohm says of its food in Europe: "The Golden Eagle has been known on one highland sheep farm alone, in the course of a single season, to carry off as many as thirty-five lambs. * * * In deer forests, eagles are of the greatest service; for although they sometimes take a sickly deer calf, they live almost entirely on the blue hares, so troublesome to the deer stalker; and most certainly the deer are the better for the removal of the weak and sickly ones, which would only possibly live to transmit their diseases to posterity. * * * The Golden Eagle (noble as he is thought to be) will eat carrion when pressed for food. * * * The Golden Eagle also preys upon various species of birds, notably the blackcock and red grouse, ptarmigan, curlews, and plovers, dropping upon them unawares or simply taking the young and weakly ones; for never does the bird pursue and strike them like the true falcon." (Hist. of British Birds, vol. I, 1883, pp. 98, 99.)

Occasionally it will attack large animals, as the following from Mr. Charles F. Morrison shows: "The bird had captured and killed a good sized black-tailed deer, and was shot while sitting upon its body." (Ornithologist and Oologist, vol. XIV, 1889, p. 25.)

To sum up, it may be stated that in sections of the country where rabbits, prairie dogs, or gophers are abundant the Golden Eagle is very beneficial, confining its attention mainly to these noxious animals; but in places where wild game is scarce it is often very destructive to the young of domesticated animals, and hence in such places has to be kept in check.

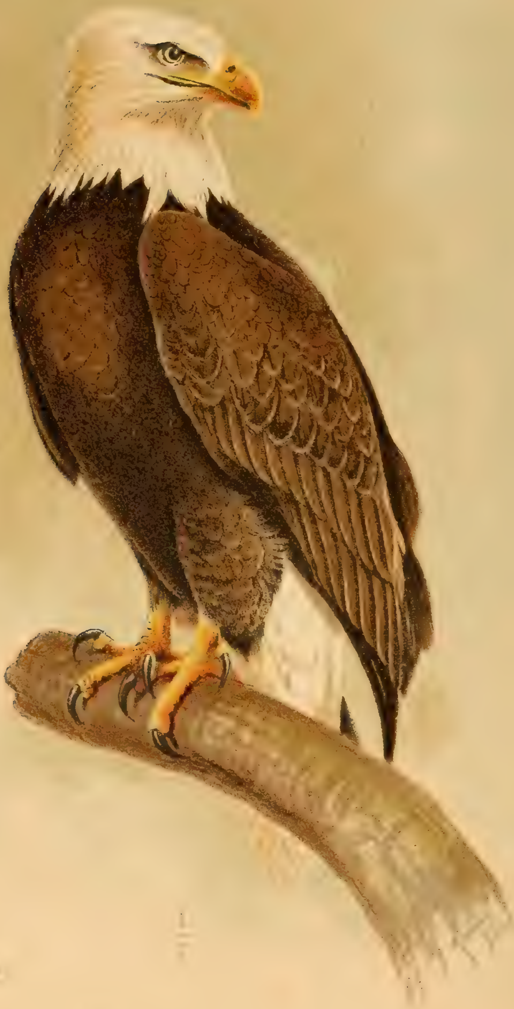
The nest usually is placed on a shelf or ledge on the face of a rocky cliff, or, in some sections of the country, among the branches of large trees. This latter site seems to be more common along the west coast than in other parts of the country. The structure is nothing more than a platform of dry sticks, some of which are several inches in diameter; and as the same place is used for a series of years and new material added each year, the mass acquires very large dimensions, often measuring from 6 to 8 feet in diameter. The cavity is shallow and is lined with dry straw, grass or moss, green leaves, or in the north, the fur and feathers of mammals and birds which have served as food.

The full complement of eggs is from one to four, two or three being the common number. In California the first half of March appears to be the time when most of the eggs are deposited. Occasionally an early set may be found in February or a late one in April. In the far north sets are not completed before the last of April or the first of May.

Some writers allege that this Eagle remains mated throughout life, which is not at all improbable, for generally two birds are seen together at all seasons. The female sits closely during incubation and is attentively cared for and assisted by the male, which, in case the female is killed, takes full charge of the brood. The male is more shy than the female, and hence is less often killed.

A great deal of nonsense has been written about the valor displayed by this bird in protecting its nest and in attacking persons who attempt to rob it of the eggs or young. Interesting as these accounts may be, they have but little foundation in fact, so far at least as this country is concerned, for the birds are arrant cowards, and as soon as the nest is approached leave the neighborhood and do not return, even when there are young in the nest, until after the foragers have passed out of gun range.

Plate 14



BALD EAGLE

[illegible]

This bird when kept in confinement is thought by many to be fierce and untamable, but there are many exceptions, for in certain sections of the West there are few towns which can not boast of a live Eagle, which is oftentimes tame and gentle. When this bird is soaring in the higher air, its flight is truly grand, being equaled in grace by that of few other species. Like many, if not all, of the birds of prey, the Golden Eagle is fond of bathing.

DESCRIPTION.

Legs densely feathered down to base of toes. This character will separate it, in any plumage, from the White-headed Eagle, which is the only other Eagle in the United States.

Length: 30 to 40 inches (760 to 1015^{mm}); extent, 75 to 90 inches (1900 to 2280^{mm}); wing, 23 to 27 inches (580 to 685^{mm}); tail, 14 to 16 inches (355 to 405 ^{mm}).

Table showing the results of examinations of 6 stomachs of the Golden Eagle (Aquila chrysaëtos).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Gaithersburg, Md	Dec. 8, 1887				Carrion.
San Francisco Mountain, Ariz.	Aug. 27, 1889			Abert's squirrel.	
Adams, Ind	Jan. 31, 1887				Empty.
Whipple Barracks, Ariz.	Dec. 14, 1885				Pig carrion.
Vermillion, Clay County, S. Dak.	Jan. 13, 1890		Feathers		
Keokuk, Iowa	Oct. 31, 1889			Rabbit	

SUMMARY.—Of 6 stomachs examined, 1 contained feathers; 2, mammals; 2, carrion; and 1 was empty.

BALD EAGLE.

Haliæetus leucocephalus.

[Plate 14—Adult.]

The Bald Eagle inhabits North America, ranging south into Mexico, as well as into the northeastern part of Siberia. It occurs along the Arctic Ocean as a summer resident only, though in the greater part of Alaska and southward it is found throughout the year, merely wandering whenever food becomes scarce. It breeds in suitable localities throughout its range.

The favorite food of the Bald Eagle is fish, and when this vertebrate can be procured the bird will touch little else. Of the hundreds of these Eagles which the writer has watched, none were observed ever to touch anything except fish or offal picked up from rivers or along their shores. What proportion of the fish consumed is taken from the Osprey is hard to estimate, but the number must be very great.

Nuttall, in speaking of the food of this bird, says: "Besides fish, he preys upon Ducks, Geese, Gulls, and other seafowl, and when the resources of the ocean diminish, or fail from any cause, particularly on the southern migration of the Osprey, his inland depredations are soon notorious, young lambs, pigs, fawns, and even deer often becoming his prey" (Land Birds, 1832, p. 75).

Mr. H. W. Henshaw, speaking of the food of this bird on the west coast, says: "They are said to annually destroy many of the lambs. I am informed by Lieut. Carpenter that this Eagle at the mouth of the Columbia River is exceedingly numerous, and that here its habits of feeding upon carrion are as regular and fixed as those of the true Buzzards. Its chief dependence is on fish, more particularly Salmon, of which vast numbers are cast up by the waves." (App. JJ, Rept. of the Chief of Engineers, U. S. A., for 1876, pp. 264, 265.)

Speaking of the food of the Bald Eagle in Alaska, Mr. E. W. Nelson says: "In summer they feed upon fish and the numerous wild-fowl which breed among these islands. In winter they feed upon Ptarmigan and the seafowl which reside there during this season. When at the salmon run, in Sanborn Harbor, Nagai, Mr. Dall saw seventeen eagles within 100 yards. During winter he found many eagles dead, but they were too fat to have starved, and he was unable to account for the mystery." (Report Nat. Hist., Collections in Alaska, 1887, p. 144.)

Mr. L. M. Turner, speaking of the same general country, says: "The food of this eagle is rather mixed, consisting of ptarmigans, ducks, and an occasional fish. Any fish or bird that may be thrown dead on the beach is eagerly eaten by this eagle." (Contrib. Nat. Hist. Alaska, 1886, p. 159.)

In parts of the West and Southwest this bird often does considerable good in destroying noxious mammals. Dr. J. G. Cooper says: "The Spanish inhabitants rather encourage its presence, on account of the great number of squirrels it kills; and I have been told of instances where young ones raised from the nest have been kept for several years in a domestic state, going out daily to kill squirrels, and returning to the house at night." (Ornith. Cal., Land Birds, 1870, p. 452.)

Mr. Wm. Lloyd, in a letter dated February 18, 1887, says: "I went to a Bald Eagle's nest on January 28, and though disappointed at finding young just ready to fly, yet I watched the parents bring two prairie dogs to the nest, and skins of this mammal were mixed up in the débris of the nest."

A very interesting instance is mentioned by Mr. Thomas McIlraith of an eagle, which was shot on the shore of Hamilton Bay, Lake Ontario, that had the bleached skull of a weasel dangling from its neck. The teeth were firmly set in the skin of the throat. (Birds of Ontario, 1886, p. 147.)

In certain sections of the country the Bald Eagle appears to be as destructive to domesticated animals as the Golden Eagle is, and undoubtedly the depredations that are mentioned in the letter to Col. Alexander Macbeth (p. 95), refer as well to the present species. The following notes from *Forest and Stream* bear on this phase of the subject: "A number of eagles have recently been shot in various parts of Pennsylvania. One, shot by John Hodman in North Coventry, Chester County, had carried off bodily a large lamb and returned the following day after another." (Vol. v, 1875, p. 195.) "A large white-headed eagle swooped down on a flock of sheep here [Hornellsville, N. Y.] and made a breakfast on lamb chops before he could be driven off." (J. Otis Fellows, vol. x, 1878, p. 319.) "It [the Bald Eagle] was killed by a Mr. Towry, near Smithsville, Miss. When found by Mr. Towry it had killed two of his hogs and was dining on one of them." (G. C. E., vol. VIII, 1877, p. 17.)

Mr. J. E. West mentions a neighbor who, while watching for geese on the river opposite Wilkinsons Point, near the mouth of Neuces River, North Carolina, saw an Eagle having something in its talons and flying across the river in his direction. As the river at this point is about five miles wide, the bird was evidently becoming very tired and kept flying lower and lower, but finally alighted on the shore within twenty steps of the gunner, who shot it. The object it carried was a little live lamb which was unhurt. (*Ibid.*, vol. IV, 1875, p. 166.) This note shows to what a great distance an Eagle is capable of carrying a burden fully equal to its own weight.

Along the coast of the South Atlantic States and on the lower Mississippi, this Eagle appears to feed more on waterfowl than in any other section of the country. The following note from Mr. William Brewster refers to the vicinity of Cobbs Island, Virginia: "In the winter the Eagles are much more numerous than at any other time of the year, and my informant has, on several occasions, seen as many as eight at once. At this season the neighboring bays and creeks swarm with Wild-fowl, and upon these the Eagles principally live. He has never known them to catch fish of any kind, although they not unfrequently rob the Fish-Hawk. Geese and Brant form their favorite food, and the address displayed in their capture is very remarkable. The poor victim has apparently not the slightest chance for escape. The Eagle's flight, ordinarily slow and somewhat heavy, becomes in the excitement of pursuit, exceedingly swift and graceful, and the fugitive is quickly overtaken. When close upon its quarry the Eagle suddenly sweeps beneath it, and, turning back downwards, thrusts its powerful talons up into its breast. A Brant or Duck is carried off bodily to the nearest marsh or sand-bar, but a Canada Goose is too heavy to be thus easily disposed of. The two great birds fall together to the water beneath, while the Eagle literally tows his prize along the surface until the shore is reached. In this way one has been known to drag a large Goose for nearly half a mile." (Bull. Nutt. Ornith. Club, vol. V, 1880, pp. 57–58.)

Mr. Charles F. Batchelder, quoting Mr. John W. Baker, mentions an

Eagle on the St. Johns River, Florida, which for a period of four or five months made two trips a day to the river for the purpose of obtaining coots (*Fulica*), which it always captured with little difficulty. (Bull. Nutt. Ornith. Club, vol. VI, 1881, pp. 58–60.)

Considerable has been written by the earlier writers about Bald Eagles attacking and carrying off children. We can find no recent record of such an occurrence—except newspaper trash—so give the following from Wilson, which seems trustworthy: "A woman who happened to be weeding in the garden had set her child down near, to amuse itself, while she was at work, when a sudden and extraordinary rushing sound, and a scream from her child, alarmed her, and, starting up, she beheld the infant thrown and dragged some few feet, and a large bald eagle bearing off a fragment of its frock, which being the only part seized, and giving away, providentially saved the life of the infant." (American Ornithology, vol. I, 1831, pp. 26–27.)

What we have said in reference to the Golden Eagle applies equally well to the bird under consideration, namely, that over the greater part of the country where the natural food, fish in the present case, is abundant it is a harmless bird and should be protected; while in sections where it is injurious to sheep or other domesticated animals it should not be allowed to become numerous.

The nest, if this rude structure is entitled to such a name, is a great mass of material in the shape of a platform, often 6 feet across and 3 or 4 feet in depth. It is composed of large sticks with more or less rubbish added in the shape of plant stalks, seaweed, rushes, pieces of turf, vines, and the like. The great majority of nests are placed in large trees, though occasionally a shelf or projecting crag from the steep mountain side is used for a site. The trees chosen are generally live ones of large size, and the nest unlike that of the osprey is placed in a crotch some distance from the top of the tree, from 50 to 60 feet above the ground.

The eggs, which are usually two in number, though occasionally three are found, are deposited at widely different times depending on latitude. In Florida the birds begin to lay in November or early in December, while in Alaska it is often April before full complements of eggs are found. In the same locality there is considerable variation in the time at which different pairs breed. In proof of this Dr. William L. Ralph, during two seasons, found twenty-six sets of eggs of this bird along the Indian River, Florida, between November 25 and February 1. The period of incubation is thirty-six days. Although in Florida the young often leave the nest by the first of April, in Labrador and the mountains of Washington it is nearly July before they do the same. Like the Golden Eagle, the Bald Eagle makes no pretense at guarding its eggs or young against intruders, but leaves the vicinity at the first appearance of the collector and does not return until all danger to itself is over. It is stated that a pair remain united through life, always keeping in the general neighborhood and sharing the products of the chase together.

In the spring when the ice in the rivers and bays is breaking up, the Bald Eagle often becomes very abundant and may be seen on a cake of ice floating back and forth with the tide or perched on some tree near the shore. On the Hudson River Dr. E. A. Mearns states that he has seen twenty-five in sight at once, and the writer, on the border of the same river, has observed nine individuals in one tree.

Like most other birds of prey, this Eagle makes a gentle and interesting pet when taken young, though there is always some danger of it being vicious towards strangers. In localities where the bird is little molested it is not at all shy, but in other sections where war is continually waged against it, it is very difficult to approach.

The flight is strong, although having the appearance of being labored at times, and the bird is capable of carrying a weight exceeding its own. At a distance the note of the Bald Eagle is not altogether unpleasant, resembling somewhat that of the sea gulls, but near by it is grating and suggests a maniacal laugh. Audubon states that the flesh of the young eagles is very good and resembles veal in taste.

DESCRIPTION.

Lower third of leg naked all around. This character will separate it in any plumage from the Golden Eagle, which is the only other Eagle in the United States.

Length: 30 to 43 inches (760 to 1090mm); extent, 80 to 96 inches (2030 to 2440mm); wing, 20 to 28 inches (510 to 710mm); tail, 11 to 16 inches (280 to 405mm).

Table showing the results of examinations of 21 stomachs of the Bald Eagle (Haliæetus leucocephalus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Jan. 28, 1887				Carrion.
Oneida Lake, N. Y	Aug. 30, 1886				Sunfish.
Do	do				Fish.
Sing Sing, N. Y	Feb. 27, 1881				Goldfish.
Paint Rock, Tex	Jan. 28, 1887			2 prairie dogs	
Gainesville, Fla	Jan. 13, 1888				Fish and offal.
Fredericksburg, Va	Dec. 5, 1889				Empty.
Rushville, Ill.	Nov. 26, 1883			Mice	
Cincinnati, Ohio	Nov. 10, 1884				Fish.
Do	Jan. 15, 1885			Rats	
Raleigh, N. C	Oct. 29, 1888				Do.
Norfolk, Va	Dec. 1882	Duck			
Isle of Haut, Me	Mar. 17, 1885				Empty.
Highland Falls, N. Y	Sept. 15, 1874				Eels.
Putnam County, N. Y	Mar. 12, 1875				Empty.
Dutchess County, N. Y.	June 2, 1876				Goldfish.
Putnam County, N. Y	Aug. 17, 1876				Empty.
West Point, N. Y	Feb. 15, 1878				Striped bass; fork-tailed catfish.
Garrisons, Putnam County, N. Y.	Mar. 27, 1883				Empty.
Mogollon Mountains, Ariz.	Jan. 8, 1888			Mule deer	
Harrison, S. Dak	Dec. 11, 1891			Meat and hair	

SUMMARY.—Of 21 stomachs examined, 1 contained a game bird; 5, mammals; 9, fish; 2, carrion; and 5 were empty.

GYRFALCONS.

Falco islandus et rusticolus.

Although Gyrfalcons are very important ornithologically and are much sought after by collectors, they possess no great interest from an economic standpoint, since they are never seen in the farming lands of the United States and Canada except in severe winters. It has been thought best, therefore, to include under one article all our four species and races of these birds.

The White Gyrfalcon (*Falco islandus*) inhabits the circumpolar regions, breeding in Greenland and the northeastern portions of Arctic America.

The Gray Gyrfalcon (*Falco rusticolus*) inhabits the extreme northern portions of Europe (except Scandinavia), Asia, and North America, including Iceland and southern Greenland; it occurs south, in winter, as far as the northern border of the United States.

The Common Gyrfalcon (*Falco rusticolus gyrfalco*) inhabits northern Europe, Arctic America from northern Labrador and coasts of Hudson Bay to Alaska.

The Black Gyrfalcon (*Falco rusticolus obsoletus*) inhabits the coast of Labrador, ranging south in winter to Maine, southern Canada, and New York.

All the forms breed far north, and are very rarely seen at any season of the year south of parallel 50°. The food of the Gyrfalcons consists mainly of ptarmigan, grouse, water-fowl, hares, and other birds and mammals of medium size, which inhabit the wild regions in company with them.

Dr. Leonhard Stejneger, speaking of *Falco rusticolus* on Bering Island in winter, says:

"It was at that season by no means uncommon, and fed chiefly on the numerous field mice which now infest that island; but, being very shy, specimens were only secured with great difficulty." (Bull. U. S. Nat. Mus., No. 29, 1885, p. 203.) Of five specimens which he examined one was empty, four contained the remains of meadow mice (*Arvicolæ*), and one the flesh and feathers of a gull.

Audubon gives the following relating to its food: "About its [the nest's] edges were strewed the remains of their food, and beneath, on the margin of the stream, lay a quantity of wings of the Uria troile, Mormon arcticus, and Tetrao saliceti, together with large pellets composed of fur, bones, and various substances. * * * Many were the instances in which I saw these warriors descend like a streak of lightning, pounce on a puffin, and carry it off in their talons." (Ornith. Biography, vol. II, pp. 552–553.)

Mr. H. A. Purdie, speaking of a specimen captured in Piscataquis County, Me., December, 1876, says: "It had caught several hens, and having pursued one under a barn through a small opening, was itself caught in the arms of a man as it came out." (Bull. Nutt. Ornith. Club, vol. IV, 1879, p. 189.)

Mr. Thomas McIlwraith writes (March 28, 1890) that a correspondent in British Columbia killed a Gray Gyrfalcon as it tried to carry off a mallard he had just shot.

The following relates to it in Greenland and the fur countries: "He [Holböll] mentions having once seen one with a young *Larus tridactylus* in each foot, and another with two *Tringa maritima* carried in the same manner. * * * Richardson often met with it during his journeys over the Barren Grounds, where its habitual prey was the Ptarmigan, and where it also destroyed Plover, Ducks, and Geese." (Hist. N. A. Birds, vol. III, pp. 119–120.)

So rare are these birds in the United States, that a man may consider himself fortunate who sees one in a lifetime.

The nest is placed usually on a ledge or crag of some inaccessible cliff, though in the Anderson River district, Northwest Territory, Mr. MacFarlane found most nests in trees. They were situated in evergreens, from 10 to 25 feet from the ground, some being in the very top, while others were on the lower limbs, resting against the trunk. The nest, which is often a couple of feet in diameter, is made of dry twigs and small branches, and contains a warm lining of moss, seaweed, dry grass, hair, or feathers. The eggs, which are usually from two to four in number, are deposited some time in May, Mr. MacFarlane finding fresh sets from the 10th to 27th of that month. The birds are said sometimes to guard their nests with determination, and even to attack persons who go near them.

There seems to be a great difference of opinion in respect to their flight. Some observers say that it is slow and clumsy, while others state that it is swift and elegant, and equal or superior to that of the Duck Hawk. It is stated that while hunting it rarely sails, but passes forward on rapidly beating wings. The note is loud, shrill, and piercing, and may be heard a long distance.

DESCRIPTION.

Large Hawks with pointed wings: Lower legs densely feathered in front and on sides for the upper two-thirds, the edges of the feathering meeting behind.

White Gyrfalcon: Prevailing color of whole plumage white, streaked with dusky.

Gray Gyrfalcon: Top of head streaked with white; above, more or less distinctly barred with very pale grayish-white or buffy-white, the lighter bars sometimes nearly equal in width to the darker ones.

Common Gyrfalcon: Darker in color than the Gray Gyrfalcon.

Black Gyrfalcon: Lower parts with dusky prevailing, sometimes almost entirely dusky.

Length: 20 to 24.5 inches (508 to 622$^{\mathrm{mm}}$); wing, 13.5 to 16.5 inches (342 to 420$^{\mathrm{mm}}$); tail, 8 to 10.5 inches (203 to 266$^{\mathrm{mm}}$).

PRAIRIE FALCON.

Falco mexicanus.

The Prairie Falcon inhabits the western United States from the eastern border of the Great Plains to the Pacific, and from the northern boundary southward into Mexico. It winters from Kansas, Colorado, southern Idaho, and southern Washington southward, and breeds in suitable localities throughout its range.

The food of this Falcon consists of birds, mammals, reptiles, and the larger insects. Among birds it is partial to prairie hens, doves, blackbirds, and in fact any species whose size furnishes a tempting lure. In the destruction of injurious rodents it is of considerable service. Gophers, prairie dogs, rabbits, and mice are greedily devoured, and often in localities where colonies of the first two animals occur it is seen flying over or sitting near the 'towns' on the lookout for the appearance of its prey. Lizards are occasionally taken, and, among the insects, the large crickets and grasshoppers which are so abundant in some sections of the West are also eaten.

The following is what Mr. Robert Ridgway says of the food of the species: "This daring Falcon was a rather common species throughout the Great Basin. It was first observed on the 31st of October, 1867, at the Humboldt Marshes [Nev.], where we saw one swoop upon a flock of tame pigeons at the stage station. Late in November, of the same year, it was noticed again among the marshes along the Carson River, near Genoa, where it was observed to watch and follow the Marsh Hawks (*Circus hudsonius*), compelling them to give up their game, which was caught by the Falcon before it reached the ground; this piracy being not an occasional, but a systematic habit. In the Truckee Valley we saw one snatch a young chicken from a dooryard, in the presence of several spectators. The quarry of this Falcon is by no means confined to animals smaller than itself, however, for the specimen in our collection was killed while leisurely eating a Jackass Rabbit (*Lepus callotis*), an animal of nearly twice his weight, and which he had carried to the top of a fence post by the roadside. He exhibited no alarm at the approach of our buggy, but continued tearing and devouring his prey. We had even passed by him, without seeing him, when the quick eye of Mr. Parker detected him in time for a shot." (U. S. Geol. Explor. of the Fortieth Parallel, King, vol. IV, 1877, p. 577.) Dr. Coues reported finding one of these birds feeding on an allied species of hare which is fully as large as the above-mentioned one.

Dr. George Bird Grinnell says of this Falcon: "It was seen daily pursuing the blackbirds about the station, and at Medicine Bow one of these birds had almost depopulated the only dove-cote in the town." (Forest and Stream, vol. XII, 1879, p. 365.)

At present the data we have on the food of this Hawk is not enough to decide whether the species should be protected or persecuted.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Spermophilus tridecemlineatus pallidus.
Spermophilus richardsoni.

BIRDS.

Lophodytes cucullatus.
Callipepla gambeli.
Tympanuchus americanus.
Zenaidura macroura.
Otocoris alpestris arenicola.
Harporhynchus crissalis.

The nest is placed usually on a shelf or in a niche on the perpendicular surface of a 'cut bank,' so common in parts of the West, or among the crevices of rocky cliffs. It is probable that this Falcon also builds in hollows of trees, as the Duck Hawk sometimes does. The eggs, which are usually three in number, though sets of four occasionally have been found, are deposited early in May, and by the latter part of July the young are able to leave the nest.

The Prairie Falcon, as the name implies, is a typical plains bird and inhabits the dry interior. In this respect it differs from the Duck Hawk, for the latter bird is not commonly met with away from tide water or the vicinity of the larger lakes, while the former is just as rare in such localities, the exception being in autumn when it is attracted to the sloughs and lake marshes by the abundance of food, at which time the two species associate.

The flight of this Hawk is swift and graceful, though in most cases it is carried on at no great distance from the ground. It is not a shy bird, except in sections where it has been persecuted and has learned that man is its worst enemy.

DESCRIPTION.

Lower leg feathered for not more than upper half, posterior side almost wholly naked. Top of head grayish brown, streaked with dusky. Above, pale grayish brown indistinctly but broadly barred with pale clay color or bluish gray. Below, white, the flanks heavily spotted or blotched with dusky.

Length: 17 to 20 inches (431 to 509^{mm}); extent, 40 to 43 inches (1015 to 1092^{mm}); wing, 11.60 to 14.30 inches (294 to 363^{mm}); tail, 6.40 to 9 inches (162 to 228^{mm}).

Table showing the results of examinations of 11 stomachs of the Prairie Falcon (Falco mexicanus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sarpy County, Nebr.	Sept. 1874	Prairie hen.			16 locusts.
Cheyenne, Wyo.	Aug. 3, 1888			Striped gopher.	
Laramie Mountains, Wyo.	Aug. 4, 1888			Richardson's gopher.	6 grasshoppers.
St. Thomas, Nev	Jan. 24, 1889		Horned lark		
Camp Verde, Ariz.	June 6, 1885	Gambel's quail.	Mourning dove		
Do	Jan. 5, 1886	do	Crissal thrasher		
Do	Jan. 15, 1887				Empty.
Do	Oct. 24, 1887				Do.
Do	Dec. 16, 1887	Hooded merganser.			
Do	Feb. 9, 1888				Do.
Birch Creek, Idaho	Aug. 7, 1890		Horned lark		

SUMMARY.—Of 11 stomachs examined, 3 contained, game birds; 5, other birds; 2, mammals; 2, insects; and 3 were empty.

DUCK HAWK.

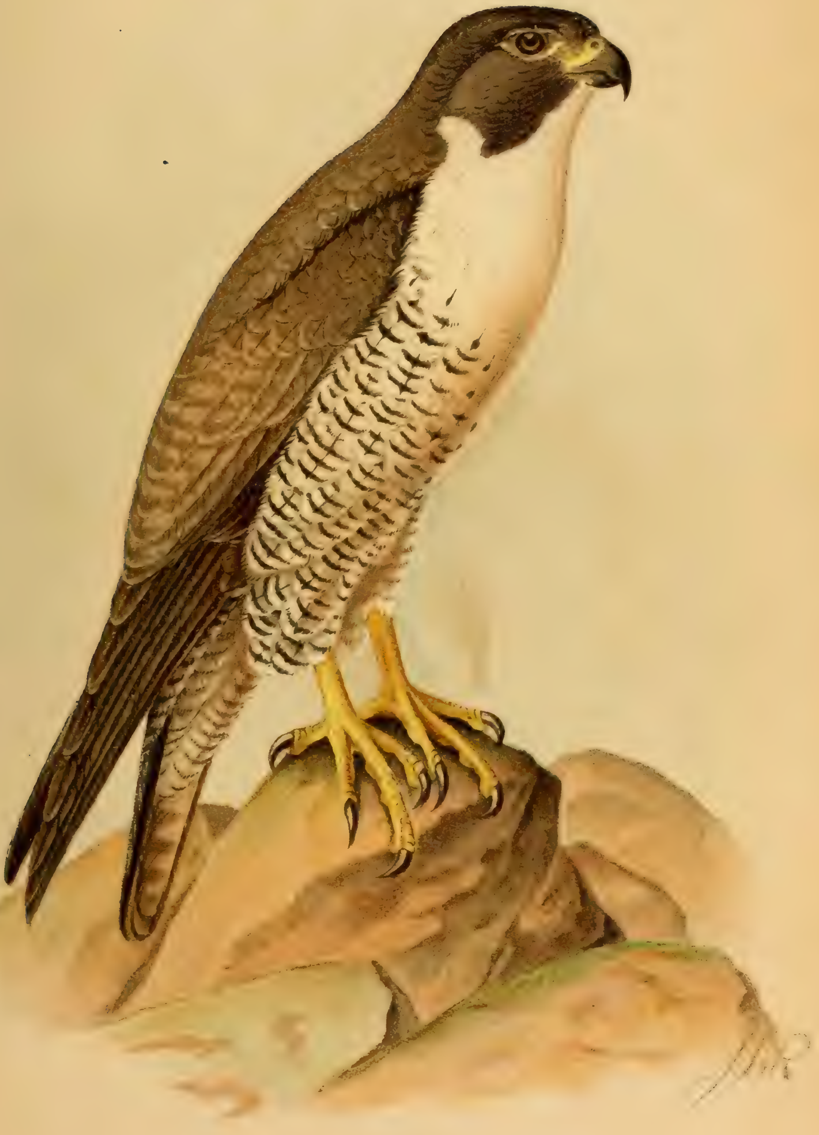
Falco peregrinus anatum.

[Plate 15—Adult.]

The Duck Hawk inhabits all of America north of Chile. The Peregrine Falcon, of which the Duck Hawk is a geographical race, inhabits Europe and parts of Asia, and appears as a migrant in northern Africa in winter. Another race, Peale's Falcon (*Falco p. pealei*), is restricted to the northwest coast region from Oregon north to the Aleutian and Commander Islands. The Duck Hawk is migratory in the northern part of its range, consequently in fall it becomes more numerous in favorite localities in the United States. On the Atlantic coast it is comparatively rare in winter north of Long Island. It breeds in the eastern United States as far south, at least, as the mountains of North Carolina and Tennessee.

The food of this Hawk consists almost exclusively of birds, of which water-fowl and shore birds form the greater part. In sections of the country where its nesting site is surrounded by cultivated lands, the bird is complained of bitterly by the farmers on account of the inroads it makes on the poultry. Speaking of a pair that had nested near Brandon, Vt., for over twenty years, Mr. F. H. Knowlton says: "They were very destructive to poultry in the vicinity, and many unsuccessful attempts were made to shoot them, until Mr. Winslow, remaining concealed near the nest for an entire day, shot both male and female as they returned about dusk." (Bull. Nutt. Ornith. Club, vol. v, 1880, p. 57.) The stomachs of two specimens secured by Mr. John Krider, not far from Philadelphia, contained the remains of poultry.

Mr. Henry Seebohm, speaking of the food of the European bird, says: "Most species of water-fowl are preyed upon, as well as Grouse and Par-



DUCK HAWK

Falco peregrinus anatum [illegible]

tridges; but perhaps his favorite food is the Rock-Doves which nestle on the ocean cliffs around him, and the Stock-Doves in the more inland districts." (Hist. British Birds, vol. I, 1883, p. 25.)

In America it often attacks pigeons, and the following note from Mr. George Boudin shows that sometimes it will take up quarters in a large city for that purpose: "On the 13th of September, 1868, I shot a fine specimen (male) at the corner of Fifth and Girard avenue, Philadelphia. For nearly three weeks this bird of prey had made its home in St. Peter's steeple, and lived on pet pigeons. Every day he would come from his hiding place and soar into the air, and start his victims into flight; after they had made two or three circles he would make a dart at the frightened birds, and never missed his prey; he would then seek his hiding place in the cupola and dine on his feathered booty." (Forest and Stream, vol. VIII, 1877, p. 161.)

It has been known also to feed on petrels, small gulls, and terns. Col. A. J. Grayson mentions one which remained near a vessel for two days and captured at least a dozen dusky petrels. (Proc. Bost. Soc. Nat. Hist., vol. XIV, 1872, p. 269.)

Dr. C. Hart Merriam, speaking of a Duck Hawk which was shot on Falkner Island, Connecticut, says: "During her brief visit she had made sad havoc among the Terns, and her crop was greatly distended with their remains, which had been swallowed in incredibly large pieces; whole legs, and the long bones of the wings were found entire and unbroken. Indeed she was perfectly gorged, and contained the remains of at least two adult Terns, besides a mass of newly-hatched young." (Birds of Conn., 1877, p. 82.)

At Oyster Bay, Long Island, New York, Hon. Theodore Roosevelt states that "a pair appeared in September, 1875, and worked great havoc among the night herons. I have seen one fly into a flock of young and kill three without picking up any."

It sometimes takes comparatively small birds. Dr. E. A. Mearns found in the stomach and crop of one he secured at Sayville, Long Island, the remains of a robin, gray-checked thrush, catbirds, and warblers; and Dr. J. G. Cooper says: "I have seen one pursue a swallow, and turning feet upwards seize it flying, with perfect ease. I have also seen them pursue quail near the coast; but their chief prey consists of ducks and other water-birds, which they seize on the wing or on the water, frequently carrying off birds heavier than themselves." (Ornith. Cala., Land Birds, 1870, p. 456.)

It will attack some of the smaller birds of prey, as the following will show: "An individual of this bird was taken by Col. Grayson at the Tres Marias Islands [Mexico]. When shot, it was endeavoring to capture a Sparrow Hawk, indicating its indifference as to the game it pursues. He adds that this bird attacks with vigor everything it sees, from the size of a Mallard Duck down, and is the terror of all small birds." (Hist. North A. Birds, vol. III, 1874, p. 138.)

Speaking of the food of this bird in Florida, Mr. W. E. D. Scott says: "As observed here, this Hawk preys almost exclusively on the Coot (*Fulica Americana*) which occurred in enormous flocks on both lake and river." (Bull. Nutt. Ornith. Club, vol. VI, 1881, p. 17.)

The Duck Hawk is one of the few birds of prey in whose favor little can be said. It is fortunate for the poultry-raisers that the species is comparatively rare throughout our country, and that it is restricted to a large extent to the shores of the ocean and inland bodies of water. The following species of birds were positively identified among the stomach contents: *Anas cyanoptera*, *Callipepla gambeli*, *Zenaidura macroura*, *Harporhynchus crissalis*, *Turdus aliciæ*, *Galeoscoptes carolinensis*, and *Merula migratoria*.

Its flight is marvelously rapid, and it is able to overtake the swift-winged ducks with comparative ease. At times it is difficult to follow with the eye its various movements while in pursuit of its prey.

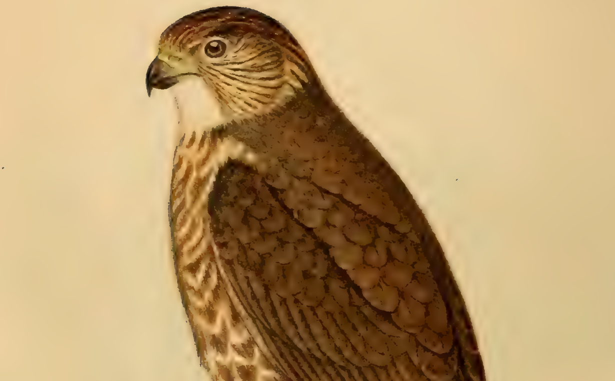
The nest is placed on some ledge or crag which projects from the surface of a rocky wall or cliff, in one of the clefts on the face of a 'cut bank,' or more rarely in the eroded cavities in the tops of tall trees. The nesting site on the cliffs is often inaccessible, being on a ledge far above the base and under an overhanging portion which prevents approach from above. Even in the far north the eggs are deposited quite commonly on the bare rocks, while in other instances a rude nest is formed of sticks and accidental material which has collected on the shelf, mixed with the fur and feathers of the victims. The holes in the giant sycamores in which Col. Goss and Mr. Ridgway found eggs, contained no nesting material except pieces of rotten wood which had fallen from the sides of the cavities. The Duck Hawk mates in February in most parts of the United States, and at such times is noisy, uttering at short intervals its peculiar note.

The eggs, which are from two to four in number, are deposited early in April, except in the far north, where their deposition is three weeks or a month later. The young are nearly fully fledged in Connecticut by the middle of June, and from Labrador northward not until a month later.

A pair of birds become very much attached to a locality and rear their young in the same place for a long series of years. This Falcon is an inhabitant of the more open country in the vicinity of the sea, the larger rivers, and inland bodies of water, and in such localities extends its range northward to beyond the limit of trees. It is rare on the dry plains of the West, which is the chosen home of the Prairie Falcon.

When taken young it, like the Old World representative, can be easily tamed and becomes much attached to its keeper. In the time of falconry the Peregrine Falcon was highly prized and was considered inferior to none except the White Gyrfalcon. It is a solitary species except during the breeding season, though in a rich hunting ground two or more may be found together, drawn there by the abundance of food. It is a bold,

[illegible] Plate 16



PIGEON HAWK.

[illegible]

audacious bird, attacking and killing prey twice its own weight. Nevertheless in some cases it seems to be tyrannized over by the much weaker Marsh Hawk, as several writers have witnessed the latter bird drive it from recently killed quarry.

DESCRIPTION.

First and second wing feathers equal and longest.

Adult.—Top of head black, decidedly darker than back; chest creamy buff, buffy white, or pure white, often unspotted, never very heavily spotted with blackish.

Immature.—Lower parts streaked with dusky. In Peale's falcon the top of the head is dark slaty, uniform with back; chest heavily spotted with blackish.

Length: 15.50 to 20 inches (393 to 508^{mm}); extent, 38.50 to 42 inches (978 to 1068^{mm}); wing, 11.30 to 14.75 inches (286 to 374^{mm}); tail, 6 to 9 inches (152 to 228^{mm}).

Table showing the results of examinations of 20 stomachs of the Duck Hawk (Falco peregrinus anatum).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Portland, Conn	Apr. 29, 1886	Duck			Beetles.
East Bradford, Pa	Feb. 14, 1886		Feathers		
Do	Mar. 27, 1880	Fowl			
Watkins, N. Y.	Oct. 28, 1887		Meadowlark		
Elmira, N. Y.	Dec. 3, 1887			2 mice	
Sayville, N. Y.	Oct. 6, 1880		Gray-checked thrush, warbler, robin, catbird.		
Brookhaven, N. Y.	Oct. 1, 1884		Small birds		Dragon-flies.
Do	Oct. 4, 1884	Duck			
Plymouth, Mass	Sept. 28, 1887		Sparrow		
Stratford, Conn	Oct. 1, 1889				Empty.
Camp Verde, Ariz	Aug. 13, 1884		Small birds		
Do	Sept. 15, 1884		Mourning dove, crissal thrasher.		
Tucson, Ariz	May 7, 1885				Empty.
Camp Verde, Ariz	July 10, 1885				Do.
Do	July 30, 1885	Gambel's quail.			
Do	May 27, 1886				Empty.
Do	Aug. 2, 1886	Cinnamon teal.	Other birds		
Do	May 11, 1887		Mourning dove		
Lancaster County, Pa.	Dec. 19, 1891	Chicken			
Do	do	do			

SUMMARY.—Of 20 stomachs examined, 7 contained poultry or game birds; 9, other birds; 1, mice; 2, insects, and 4 were empty.

PIGEON HAWK.

Falco columbarius.

[Plate 16—Immature.]

The Pigeon Hawk inhabits the whole of North America from the Arctic Ocean southward to the West Indies, Central America, and northern South America. It breeds chiefly north of parallel 43°, though in the mountains it extends south of this latitude, and in the mountains of some of the West Indian Islands it is a summer resident. It winters sparingly from the more southern portions of its breeding range through the intermediate country to South America. The Black Merlin (*Falco c. suckleyi*), a dark race of the Pigeon Hawk, inhabits the northwest coast from northern California to Sitka.

The food of the Pigeon Hawk consists mainly of small and medium-sized birds, especially the gregarious species, insects, and occasionally small mammals. Pigeons, flickers, and grackles are about as large birds as it usually attacks, though Dr. Dall in one instance saw it kill a ptarmigan and Dr. E. A. Mearns speaks of a specimen shot in the act of destroying a hen. Among insects the dragon flies are favorite morsels for this Hawk, and the apparent ease with which it captures these nimble-winged insects demonstrates better than anything else its remarkable power of flight. The writer has also found grasshoppers, crickets, and beetles among the stomach contents.

Like the Duck Hawk, the species under consideration occasionally captures small mammals when its ordinary food is scarce, though according to Dr. J. G. Cooper, it sometimes feeds quite extensively on them. He says: "Though small, the pigeon hawk has all the fierceness and courage of a true falcon, and captures birds fully as large as itself. It, however, chiefly follows the flocks of gregarious birds, such as blackbirds, doves, etc., and preys much on mice, gophers, and squirrels. I have not heard of its attacking domestic poultry, and those farmers who shoot every 'chicken hawk' that comes around the house would do well to observe them more closely, and will discover that these small species are not the young of the larger ones, and should rather be encouraged than destroyed." (Ornith. Cala., Land Birds, 1870, p. 461.)

Wilson sums up its food as follows: "When the reedbirds, grakles, and red-winged blackbirds congregate in large flights, he is often observed hovering in their rear, or on their flanks, picking up the weak, the wounded, or stragglers, and frequently making a sudden and fatal sweep into the very midst of their multitudes. The flocks of robins and pigeons are honored with the same attentions from this marauder." (Am. Ornithology, vol I, 1831, pp. 61, 62.)

Audubon speaks of its food as follows: "It seizes the Red-breasted Thrush, the Wild Pigeon, and even the Golden-winged Woodpecker, on land; whilst along the shores it chases several species of snipes, as well as the Green-winged Teal." (Ornith. Biography, vol. I, p. 467.)

Mr. John Murdoch mentions four Pigeon Hawks which, on September 5, came out to the vessel as it was crossing the Gulf of St. Lawrence, and says: "The first that appeared had a Leach's Petrel, dead, in his talons. He alighted with this, on the fore crosstrees, and proceeded to eat it." (Bull. Nutt. Ornith. Club, vol. II, 1877, p. 79.)

Dr. Coues, speaking of the species in Labrador, says: "On the 25th of the same month [August], at Henley Harbor, another individual was seen foraging among the immense flocks of Curlews (*Numenius borealis*) which then covered the hills in the vicinity." (Proc. Acad. Nat. Sci., Phila., 1861, p. 216.)

In Texas, Mr. George B. Sennett secured a bird whose crop contained nearly the whole of a ground dove. Mr. Thomas McIlraith mentions seeing one of these Falcons dive into a flock of blackbirds on one ot the marshes of Ontario, and says: "I once saw him 'stoop' on a flock as they hurried toward the marsh for shelter. How closely they huddled together, as if seeking mutual protection, but he went right through the flock and came out on the other side with one in each fist." (Birds of Ontario, 1886, p. 149.)

Occasionally the Pigeon Hawk is quite destructive to young chickens, as the following from the pen of the late Dr. William Wood will show: "In May, 1860, a gentleman who resides some five miles distant, informed me that a small hawk came almost every day and carried off a chicken for him. * * * The next day the same little hawk returned and was shot, and is now in my collection, a beautiful representative of the pigeon hawk." (Am. Nat., vol. VII, 1873, p. 342.)

The following from Dr. B. H. Warren shows it is also injurious to domesticated birds other than chickens: "Two Pigeon Hawks during the late fall lurked about the southern suburbs of the borough of West Chester, preying at regular intervals on the pigeons of a blacksmith. In one week the hawks killed or drove away fifty of the birds. The hawks would enter the boxes and take from them the pigeons." (Birds of Pennsylvania, 1888, p. 100.)

The following species of birds were positively identified among the stomach contents:

Colaptes auratus.
Chœtura pelagica.
Dolichonyx oryzivorus.
Spinus tristis.
Certhia familiaris.
Junco hyemalis.
Spizella pusilla.
Spizella socialis.
Melospiza faciata.
Melospiza georgiana.
Passerina cyanea.
Tachycineta bicolor.
Passer domesticus.
Dendroica palmarum.
Vireo olivaceus.
Vireo solitarius.
Turdus.

The nesting site of the Pigeon Hawk is very varied. In some instances the bird deposits its eggs on a ledge or in a cavity on the face of a cliff, in others in the hollows of trees or in nests made among their branches, and occasionally in the deserted nests of other birds. The eggs, deposited on the ledges or in the cavities of cliffs, like those of the Duck Hawk, rarely have much nesting material surrounding them, while those in trees are placed in quite bulky nests. These latter nests, which are found generally in evergreens from 8 to 15 feet from the ground, are composed of twigs, dry grass, and moss, lined with feathers, inner bark, or other soft material.

In California the Pigeon Hawk generally has a full complement of eggs by the middle of April, while in the mountains of Colorado, in Labrador, and farther north, the eggs are not usually all deposited before the 1st of June. The complement of eggs varies from four to six; five being the most common, and six the rarest number. Often when the nest is approached both birds will dart at the intruder, circling within a few feet of his head, at the same time uttering shrill, chattering screams.

This Falcon, with the exception possibly of the Broad-winged Hawk, is the least shy of all of our diurnal birds of prey, and often may be approached within a few rods. It frequents the more open country and edges of woods and is common along the shores of large bodies of water. In September and October during the fall migrations large numbers pass along certain of the sea beaches. The writer was once informed by his lamented friend William L. Breese that on several occasions he had seen hundreds of these little Hawks during the course of a day migrating along the meadows and outer beaches on the south side of Long Island and New Jersey coast.

The flight is very rapid, and resembles that of the wild pigeon quite closely; nor does the similarity end here, for while sitting on a tree the general poise is that of a pigeon in repose, and specimens have been mistaken and shot for the latter bird.

DESCRIPTION.

Middle tail feathers crossed by not more than four blackish or five light bands. Above, bluish gray or brownish; below, whitish, buffy, or light rusty, streaked with brownish or dusky. The Black Merlin is much darker: Above, plain brown; below, heavily marked with dusky.

Length: 10 to 13.25 inches (254 to 336^{mm}); extent, 23.75 to 26.50 inches (604 to 673^{mm}); wing, 7.40 to 8.60 inches (188 to 218^{mm}); tail, 4.65 to 5.50 inches (118 to 139^{mm}).

Table showing the results of examinations of 56 stomachs of the Pigeon Hawk (Falco columbarius).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Shelter Island, N. Y.	Sept. 11, 1886		Small bird		
Portland, Conn	May 6, 1886		Swift.		
Lockport, N. Y.	May 14, 1886		Song sparrow		
Rockville, Conn	Sept. 20, 1886				25 crickets, 6 grasshoppers.
Long Island City, N. Y.	May 3, 1886		English sparrow		
Sayville, N. Y	Sept. 14, 1887				Dragon-flies, other insects.
East Hartford, Conn	Sept. 10, 1887		Small bird		
Sing Sing, N. Y.	May 3, 1880		Feathers		
East Hartford, Conn	Sept. 24, 1886		Indigo bird		
West Chester, Pa.	Feb. 20, 1878		Feathers		
Barton, N. Y	Aug. 2, 1886		Flicker		
Do	do			Field mice	Insects.
Do	Aug. 3, 1886			do	Do.
Elmira, N. Y	June 4, 1886		English sparrow		
Do	do		do		

Table showing the results of examinations of 56 stomachs of the Pigeon Hawk (Falco columbarius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Elmira, N. Y	July 3, 1885				Grasshoppers, small beetles.
Horseheads, N. Y	Aug. 14, 1885				Small insects.
Elmira, N. Y	Aug. 29, 1885				Grasshoppers, beetles.
Gainesville, Fla	Jan. 4, 1888		Field sparrow, warbler.		
Sing Sing, N. Y	Sept. 26, 1888		Swamp sparrow, chipping sparrow.		
Oakdale, Suffolk County, N. Y.	Sept. 6, 1888		Bobolink		Dragon-fly.
Do	Sept. 20, 1888		Warbler (?)		Dragon-fly.
Queens County, N. Y.	Sept. 24, 1888		Warbler		Dragon-flies, grasshoppers.
Oakdale, Suffolk County, N. Y.	Oct. 12, 1888		2 chipping sparrows.		
Fairfax County, Va	Oct. 13, 1889		Warbler		
Nyack, N. Y	Aug. 10, 1889		Small bird		
West Goshen, Pa	Sept. 29, 1879		Sparrows, pigeon.		
Good Ground, Long Island, N. Y.	Sept. 19, 1882		Small bird		
Montauk Point, N. Y.	Sept. 11, 1885				Grasshoppers, dragon-flies, other insects.
Hunnewells Point, Me.	Sept. 23, 1886		Sparrow (?)		
New Orleans, La	Sept. 24, 1888		White-bellied swallow.		Dragon-flies, caterpillar.
Do	Oct. 4, 1888		English sparrow		Dragon-flies, beetles.
Kenner, La.	Nov. 14, 1888		Swamp sparrow		
Raleigh, N. C	Apr. 21, 1888		2 sparrows		
Do	Apr. 22, 1888				Empty.
Albany County, N. Y	Dec. 1, 1881		Sparrow		
Do	Sept. 8, 1887		Feathers		
Rensselaer County, N. Y.	Sept. 10, 1885		Small bird		
Do	Oct. 3, 1887		English sparrow, small bird.		
Anglesea, N. J.	Oct. 6, 1889		Feathers		
Montauk Point, N. Y.	Sept. 19, 1889		2 Red-eyed vireos		3 dragon-flies.
Lawrence, N. Y.	Sept. 23, 1889		Vireo, brown creeper.		
Oakdale, N. Y.	Sept. 25, 1889		Red-eyed vireo, other small bird.		
Rockaway Beach, N. Y.	Oct. 5, 1889		2 small sparrows		3 large dragon-flies.
Lockport, N. Y.	May 9, ——	Young chicken	Thrush		
Highland Falls, N. Y.	Sept. 16, 1880	Poultry			
Mogollon Mts., Ariz.	Oct. —, 1885				Empty.
Camp Verde, Ariz.	Nov. 3, 1887				Do
Keokuk, Iowa	Aug. 21, 1889		Small birds		
Portland, Conn.	Sept. 10, 1890		Goldfinch, snowbird.		
Ballston, Va.	Oct. 14, 1891		2 English sparrows, 1 other bird.		
Washington, D. C.	Apr. 19, 1892		Swamp sparrow		
Portland, Conn.	May 9, 1891				Do
Do	Sept. 28, 1891				3 dragon-flies.
Do	Oct. 2, 1891				Empty.
Shrewsbury, Mass.	Sept. 17, 1891		1 goldfinch, song sparrow.		

SUMMARY.—Of 56 stomachs examined, 2 contained poultry; 41, small birds; 2, mice; 16, insects; and 5 were empty.

RICHARDSON'S MERLIN.

Falco richardsonii.

Richardson's Merlin inhabits the interior of North America, breeding from Colorado and western Kansas northward, and wintering in Texas, Arizona, and probably Mexico. Stragglers are found westward as far as the Pacific coast. This Falcon is so closely related to the Pigeon Hawk, the main difference being its lighter color, that it is with the greatest hesitation that the writer treats of it separately, especially as intermediate specimens are at hand. So far as known there is nothing in the food, nesting, or other habits in which it differs in the least respect from the Pigeon Hawk, and what is said under the latter bird applies equally well to the former. A specimen shot by Dr. Coues, at the headwaters of the Mouse River, North Dakota, September 8, 1873, was found to contain the remains of a sparrow. The only stomach the writer has examined personally contained the remains of a Lincoln's sparrow, and was collected by Mr. Charles W. Richmond, in Gallatin County, Montana.

DESCRIPTION.

Middle tail feathers crossed by 5 dark and 6 light bands.

Size and color much the same as the Pigeon Hawk, but averaging lighter.

Table showing the results of examinations of 4 stomachs of Richardson's Falcon (Falco richardsonii).

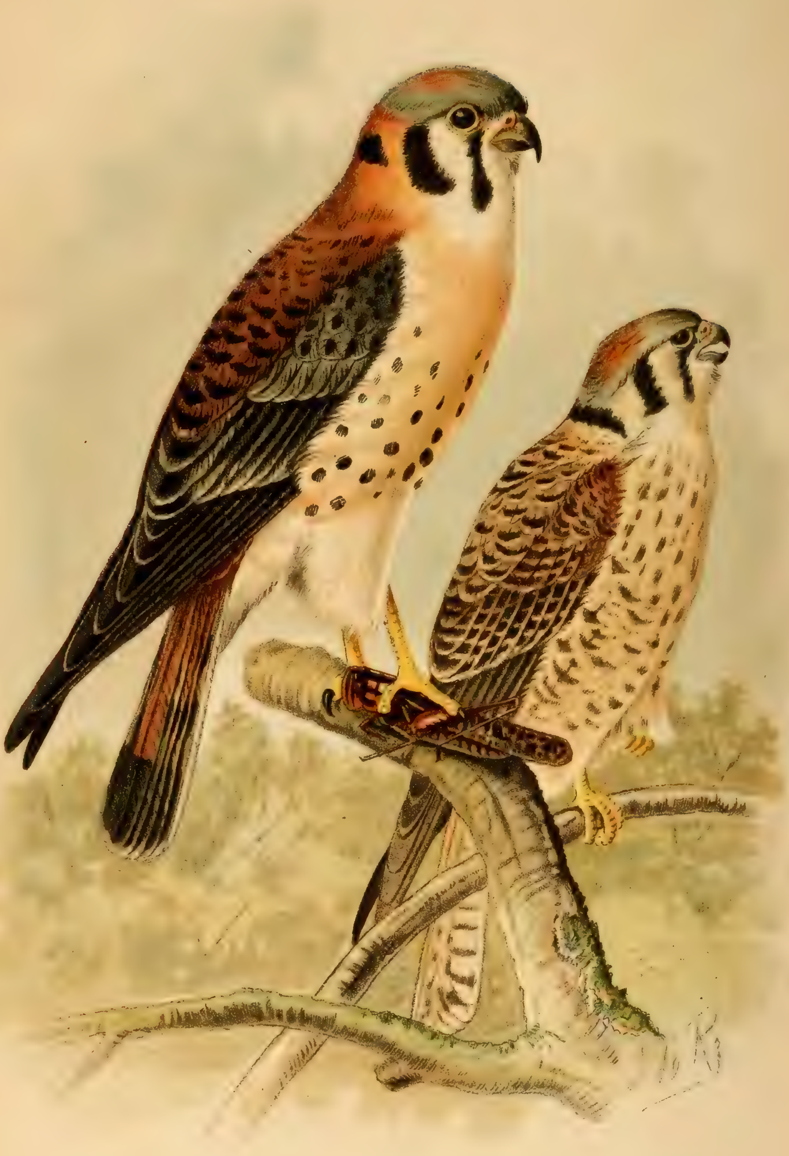
Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Madison River, Mont.	Sept. 23, 1888		Lincoln's sparrow.		
Camp Verde, Ariz.	Dec. 9, 1887				Empty.
Vermillion, Clay Co., S. Dak.	Mar. 12, 1890		Goldfinch		
Harrison, S. Dak.	Sept. 14, 1891				10 crickets, 1 caterpillar.

SUMMARY.—Of 4 stomachs examined, 2 contained birds and 1 insects, and 1 was empty.

APLOMADO FALCON.

Falco fusco-cœrulescens.

The Aplomado Falcon is a tropical species inhabiting the greater part of South America, Central America, Mexico, and extending northward into southern Texas, New Mexico, and Arizona. The plains, which bear a scattered growth of yucca, mesquit, and cactus, are the home of this bird; and in portions of Arizona and New Mexico, where this character of country exists, it is not an uncommon species.



SPARROW HAWK

Falco sparverius Linn.

Its food, probably like that of the Pigeon Hawk, consists largely of small birds, insects, and mammals, though little is known positively in reference to it.

Its flight is light and easy. While hunting for food it often hovers over certain spots after the manner of the Sparrow Hawk, and when alighting it generally chooses the bare ground to rest on. Some observers report the bird as being very shy, while others state it is quite tame and unsuspicious.

The nesting site is as variable as the surroundings will allow; sometimes the structure is placed in a yucca or cactus 10 or 15 feet from the ground; while at other times it may be found in a mesquit or other bush a few feet above the surface of the plain. The nest is composed of small twigs and plant stalks and usually has a lining of grass. When the abandoned nests of other birds are available, they are used. The eggs, which are generally three in number, are deposited at any time between the first of April and the middle of May, according to the inclination of the bird. Captain Bendire mentions three young which were found in southern Arizona on April 25, and sets of eggs have been found as late as the middle of June, which shows how variable is the time of nesting.

DESCRIPTION.

Wing more than 9 inches (228 mm.). Above, plain bluish gray; tail darker toward end, tipped with white, and crossed by about eight narrow bands of the same; broad stripes behind eye; chin, throat, and chest, white; the stripe back of the eye changing to orange-rufous on back of head where the two of opposite sides unite. Sides and flanks slaty blackish, narrowly barred with white.

Length: 15 to 18 inches (380 to 457^{mm}); wing, 9.25 to 11.50 inches (234 to 291^{mm}); tail, 6.25 to 8.75 inches (159 to 222^{mm}).

SPARROW HAWK.

Falco sparverius.

[Plate 17 — Adult male and female.]

The Sparrow Hawk is probably the best known as well as the smallest and one of the handsomest of American Hawks. It ranges over the entire continent of temperate North America, breeding in suitable localities from Maine to California, and from the fur countries southward into Mexico. Its nest has been taken as far north as Fort Resolution (latitude 62°), on Great Slave Lake, which probably is near the most northern limit of its distribution. It is reported as rare in most parts of New England, though there are certain sections where it is fairly common. In the mountains of the west and in most parts of the south it is abundant, and at certain times of the year is common on the Great Plains. In winter a few hardy individuals remain in southern New England and New York, but the species is not common as a winter resident until the latitude of Maryland and Virginia is reached; thence southward it becomes more and more plentiful. In the Mississippi Valley it does not range quite so far north in winter as along the Atlantic, for few are found above the thirty-eighth parallel. Along the Pacific coast it winters considerably further north than in the East.

The subject of the food of this Hawk is one of great interest, and considered in its economic bearings is one that should be carefully studied. The Sparrow Hawk is almost exclusively insectivorous except when insect food is difficult to obtain. In localities where grasshoppers and crickets are abundant these hawks congregate, often in moderate-sized flocks, and gorge themselves continuously. Rarely do they touch any other form of food until, either by the advancing season or other natural causes, the grasshopper crop is so lessened that their hunger can not be appeased without undue exertion. Then other kinds of insects and other forms of life contribute to their fare; and beetles, spiders, mice, shrews, small snakes, lizards, or even birds may be required to bring up the balance. In some places in the West and South telegraph lines pass for miles through treeless plains and savannas. For lack of better perches the Sparrow Hawks often use these poles for resting places, from which they make short trips to pick up a grasshopper or mouse which they carry back to their perch. At times, when grasshoppers are abundant, such a line of poles is pretty well occupied by these hawks.

A dozen or more stomachs collected by Mr. Charles W. Richmond, in Gallatin County, Mont., during the latter part of August and early part of September, 1888, were kindly turned over to this Division for examination. They contained little else than grasshoppers and crickets.

Mr. W. B. Hall, of Wakeman, Ohio, writes to us on the subject as follows: "The Sparrow Hawk is a most persistent enemy of the grasshopper tribe. While the so-called Hawk law was in force in Ohio I was township clerk in my native village and issued certificates to the number of eighty-six, forty-six being for the Sparrow Hawk. I examined the stomachs and found forty-five of them to contain the remains of grasshoppers and the elytra of beetles, while the remaining one contained the fur and bones of a meadow mouse (*Arvicola riparius*)."

Mr. W. E. Saunders writes from London, Canada: "Sparrow Hawks are one of our best grasshopper destroyers; four out of every five I have killed contained grasshoppers alone." The following from the pen of Mr. H. W. Henshaw substantiates what we have said in regard to its fondness for grasshoppers: "It finds * * * an abundant supply of game in the shape of small insectivorous birds; but more especially does its food consist of the various kinds of coleopterous insects and grasshoppers, of which it destroys multitudes. In fact, this last item is the most important one of all, and where these insects are abundant I have never seen them have recourse to any other kind of food." (Explor. West of 100th Merid., Wheeler, vol. v, 1875, p. 414.)

And subsequently the same author writes: "The west side of Chewaucan Valley has suffered severely from a visitation of that scourge of the western farmer, the grasshoppers. Here in August the sparrow hawks had assembled in hundreds and were holding high carnival, and although in instances like the present their numbers proved wholly insufficient to cope against the vast myriads of these destructive insects, yet the work of the sparrow hawk is by no means so insignificant that it should not be remembered to his credit and earn him well-merited protection. His food consists almost entirely of grasshoppers, when they are to be had, and as his appetite appears never to become satiated, the aggregate in numbers which are annually destroyed by him must be enormous." (Appendix O O of the Annual Report of the Chief of Engineers, U. S. A., for 1879, p. 314.)

The late Townend Glover, formerly entomologist of the United States Department of Agriculture, states that the beneficial traits of this hawk more than counterbalance any harm it may do, and says: "In proof of this, a Sparrow Hawk, shot in October among a flock of reed or rice birds, was found to be filled with grasshoppers, and contained not the slightest vestige of feathers or bones of birds. This bird was remarkably fat." (U. S. Agric. Report, 1865, p. 37.)

Mr. C. J. Maynard, writing on the food of the Sparrow Hawk at Miami, Fla., says: "They have nothing to do but to pick up grasshoppers, of which they appear never to tire. It is true that they can find green grasshoppers and brown grasshoppers, grasshoppers with wings and wingless grasshoppers, but still, as far as any distinctive taste is concerned, there must be but little variation. Yet, to all appearances, the Hawks are satisfied, for I never saw one take any other kind of food." (Birds of Eastern North America, 1881, p. 297.)

Dr. J. G. Cooper says: "This little hawk resides constantly in California, frequenting chiefly the plains, and feeding on grasshoppers, mice, gophers, etc. It must be considered one of the farmers' best friends, and is seldom killed by observing persons." (Ornith. Cal., Land Birds, 1870, p. 463.)

In the vicinity of Washington, D. C., remarkable as it may appear to those who have not interested themselves specially in the matter, it is the exception not to find grasshoppers or crickets in the stomachs of Sparrow Hawks, even when killed during the months of January and February, unless the ground is covered with snow.

It is wonderful how the birds can discover the half-concealed, semi-dormant insects, which in color so closely resemble the ground or dry grass. Whether they are attracted by a slight movement, or distinguish the form of their prey as it sits motionless, is difficult to prove, but in any case the acuteness of their vision is of a character which we are unable to appreciate. Feeding on insects so exclusively as they do, it is to be presumed that they destroy a considerable number of beneficial kinds, as well as spiders, which they find in the same localities as the grasshoppers. However, examination of their stomach contents shows the number to be so small, compared with that of the noxious species, that it is hardly worth considering.

After the severe frosts of autumn and in winter, when insect life is at its lowest ebb, the Sparrow Hawks devote more time to the capture of mice and small birds. As a rule, the birds which they capture at this time are ground-dwelling species, which simulate the movements of mice by running in or about the dry grass and weeds. They are mostly sparrows, more or less seed-eating, and hence not among the species most beneficial to the agriculturist. At this season it is common to see Sparrow Hawks sitting on the poles over hay stacks, or stationed where they can command a good view of the surroundings of a hay mow or grain crib, ready at any moment to drop upon the mouse which is unfortunate enough to show itself. In this way they manage to destroy a vast number of mice during the colder months.

In the spring, when new ground or meadow is broken by the plow, they often become very tame if not molested. They fly down, even alighting under the very horses for an instant in their endeavor to capture an unearthed mouse or insect.

The following extract from a letter from W. P. McGlothlin, of Dayton, Columbia County, Wash., dated February 12, 1887, contains some interesting facts on this particular subject: "There is a small hawk here called the Sparrow Hawk. It comes about the 1st of March and leaves with its young about August 1st. On their arrival they are in large flocks and seem very hungry. I have had a number follow my team all day long and even alight for a moment on the plow beam. When a mouse was unearthed it was captured in an instant and quickly killed. The hawks seem to know just when their victims are dead. They settle on something suitable to their fancy and commence eating the eyes, and then soon finish. For two weeks this mouse catching goes on. I have sometimes seen them chase and catch small birds. They pair off and drive some woodpecker from his cozy nest in an old tree, where they lay from four to six eggs. When they have young, the small chickens must suffer. About two each day for every nest seems to satisfy them."

Mr. Thomas McIlwraith, in his 'Birds of Ontario,' gives the following on the food of this Hawk: "Though sometimes seen near the farmhouse it does not bear the stigma of having felonious intentions toward the occupants of the poultry yard, but is credited with the destruction of large numbers of mice. * * * It also feeds freely on snakes, lizards, grasshoppers, etc., but has the true falcon etiquette of taking only what is newly killed" (p. 150).

In the opinion of many people, unaccountable as it may appear, the benefit accruing from the destruction of a great number of mice or other injurious mammals or insects by hawks does not offset the damage done by the capture of one bird or chicken. This, of course, is not the case with those intelligent farmers who recognize the benefit done by this little hawk, and are not prejudiced against it if it exacts a moderate interest now and then in the shape of a young chicken or bird. In May and June, when the hawks are busy hatching their eggs and rearing their young, there is less time for them to procure their favorite food.

It is during this period, as we might expect, that a very large proportion of the birds which they capture in the course of the year is taken. It is also at this time that we hear complaints of their depredations in the poultry yard.

From the following note it may be seen that occasionally they take also old birds from the nests: "In Elizabeth, N. J., several years ago, I saw a pair of Sparrow Hawks fly up under the eaves of an old barn and drag a couple of swallows out of their nests." (Merriam, Review of the Birds of Connecticut, 1877, p. 85.)

That the Sparrow Hawk at times attacks and kills comparatively large birds is vouched for by Mr. C. S. Brimley, of Raleigh, N. C., and Mr. W. G. W. Leizear, of Sandy Spring, Md., both of whom have surprised it while feeding on full-grown quail. And we have found remains of the meadowlark in the stomachs examined.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Arvicola riparius.
Arvicola austerus.
Mus musculus.
Sitomys americanus.
Sitomys a. michiganensis.
Blarina exilipes.
Blarina brevicauda.
Sigmodon hispidus.

BIRDS.

Columbigallina passerina.
Sturnella magna.
Sturnella magna neglecta.
Agelaius phœniceus.
Junco hyemalis.
Poocætes gramineus.
Spizella monticola.
Spizella pusilla.
Melospiza fasciata.
Passer domesticus.
Vireo solitarius.
Zonotrichia coronata.
Zonotrichia l. intermedia.
Thryothorus ludovicianus.

This little Hawk guards the vicinity of its home or hunting ground with zealous care, resenting the invasions of the larger species. The writer has often seen a Red-tailed or Red-shouldered Hawk enter a locality in which a Sparrow Hawk was perched on the top of some tall tree, evidently thinking he had a prior right to the whole region. As soon as the large hawk approached near enough the Sparrow Hawk launched out in pursuit, and in a very short time the intruder was convinced that hunting could be carried on to better advantage in other places. In making an attack the Sparrow Hawk always rises above its enemy and darts down, striking with bill and talons.

In a locality where it is very little molested it is quite tame and unsuspecting, often allowing a person to approach as near as 20 yards before taking wing, and when flushed it flies but a short distance. It is quite another matter to advance upon one in places where it is more or less hunted. Experience seems to have taught it just how far a gun will carry, and generally it will leave the perch just before an effective point is reached. After following it for an hour or more and taking a few chance shots, the collector usually gives up in disgust and leaves the Hawk in as good spirits as when first seen.

The Sparrow Hawk builds its nest in hollows of trees, either in natural excavations which are formed by erosion of the dead wood by the elements, or in holes made by the larger woodpeckers. If the flicker (*Colaptes*) is the bird imposed upon, which is most often the case, it never openly battles with the Hawk for the retention of its home, but sometimes annoys the latter by removing the nesting material as fast as it is deposited, making it finally necessary for one of the Hawks to remain near to guard the nest.

The cavity chosen is usually a considerable distance from the ground, rarely under 20 feet and often in the tops of the highest trees. In the West, on account of its mode of nesting, the species is more or less restricted in the breeding season to the vicinity of timber, though in some localities it nests in cavities in limestone cliffs or in holes made by kingfishers in the sand banks. It has been stated that occasionally the deserted nests of crows or other birds are made use of, but this habit must be extremely rare. Capt. Charles E. Bendire, whose field experience in the West has been extensive and varied, and often in places where birds by force of circumstances are not able to follow a fixed habit, informed the writer that on one occasion only did he suspect this hawk of breeding in an open nest. In the case in point the evidence was anything but satisfactory, for although the birds were seen near the nest, which was situated in a very large tree, he thought there might have been a cavity which was not visible from the ground. In California, Prof. B. W. Evermann has found it using the deserted nest of the magpie. (Auk, vol. III, 1886, p. 93.) This is not so strange, for we might expect the entrance in the side of the canopied nest of the magpie, simulating an opening in the side of a tree, would attract the hawk, especially in a locality where desirable hollows are scarce.

Dr. William Wood mentions the following interesting instance of departure from its usual nesting habit: "A farmer made a dove house inside of his barn with holes through the sides of the building communicating with it. A pair of doves that had nested there were attacked and killed by a pair of sparrow hawks, who took possession of their nest, laid four eggs, and commenced to sit." (American Naturalist, vol. VIII, 1874, p. 268.)

Mr. John H. Sage (Ornithologist and Oölogist, VI, 1881, 6), reports a similar occurrence at Portland, Conn., where a pair of Sparrow Hawks occupied a pigeon box, but unlike in the preceding case they were in perfect harmony with the pigeons, as the latter occupied three of the other nests at the same time the Hawks were endeavoring to raise their brood.

In Florida it begins to breed early in March; in the latitude of New York about the middle of May, and in the northern part of its range it is probably June before the eggs are deposited. The number of eggs in one nest is usually five, rarely more.

Its ordinary flight is irregular and not long continued. Even in migration it often stops to rest on a tree top or fence post, where it may remain a considerable time. Still it is capable of very rapid flight. It rarely if ever soars as do most of the other Hawks. Sometimes it makes a succession of rapid beats with its wings and sails for a short distance, but usually, when in search of food, instead of circling it hovers, remaining stationary with rapid-moving wings. If it perceives its quarry it drops to the ground to seize it, and, if successful, bears it away to a neighboring stub or fence pole to devour.

DESCRIPTION.

Small, wings narrow and pointed; top of head bluish gray or dark slate, the crown with or without a rufous patch.

Male.—Tail chestnut rufous, crossed by a broad black band near end; wings grayish blue, more or less spotted with black. Above: Rufous, with or without black bars or spots. Below: Varying from white to deep rufous, with or without black spots.

Female.—Tail, wings, and back crossed by numerous narrow bands of dusky.

Length: 8.75 to 12 inches (222 to 305^{mm}); extent, 20.75 to 22.75 inches (527 to 577^{mm}); wing, 6.55 to 8.15 inches (166 to 207^{mm}); tail, 4.20 to 5.60 inches (105 to 142^{mm}).

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Locust Grove, N. Y.	Aug. 18, 1885				Spider, grasshoppers.
Sing Sing, N. Y.	Sept. 22, 1885				Insect remains.
Washington, D. C.	Nov. 3, 1885				Grasshoppers, crickets.
Alfred Centre, N. Y	Sept. 4, 1885				Larvæ.
Volusia County, Fla	Mar. 1, 1885				Lizard.
Do	Apr. 4, 1885				2 lizards, insect remains.
Peterboro, N.Y.	July 13, 1886			Hair of mice	
Do	July 24, 1886				Grasshoppers, crickets.
Do	do		Sparrow		Crickets.
Chester County, Pa	July 28, 1886				Grasshopper and cricket.
Do	do				Grasshoppers and crickets.
Do	Feb. 24, 1886				Larvæ.
East Windsor Hill, Conn.	Feb. 4, 1886				Empty.
Maplewood, N. J	Jan. 16, 1886		Song sparrow		
Do	May 25, 1886		Vireo		
Lockport, N. Y.	Aug. 31, 1886				30 crickets.
Peterboro, N. Y	July 24, 1886				Grasshoppers and crickets

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Avon, Ohio	July 5, 1886				Remains of insects.
Baddeck, Nova Scotia	Aug. 13, 1886				Grasshoppers.
Gainesville, Fla	Apr. 20, 1887				Lizard, beetle, larvæ.
Harwood, N. Dak	July 13, 1887			Mouse	
Long Island City, N.Y.	Sept. 16, 1887				Grasshoppers and crickets.
East Hartford, Conn	Sept. 9, 1887				Do.
Portland, Conn	Apr. 12, 1887			Meadow mouse	Remains of insects.
Devils Lake, N. Dak	Aug. 13, 1887				Snake, grasshoppers, crickets, larvæ.
Bottineau, N. Dak	Aug. 27, 1887				Cricket.
Washington, D. C	Dec. 24, 1887			House mouse	Grasshoppers, beetles.
Do	do				Grasshoppers.
Do	Dec. 25, 1887			House mouse	6 grasshoppers.
Do	Dec. 27, 1887		English sparrow		Grasshoppers.
Sing Sing, N. Y	Apr. 10, 1880				Do.
Do	Jan. 29, 1883			Meadow mouse	
Do	Jan. 14, 1885			do	
East Hartford, Conn	Sept. 18, 1886		Song sparrow		
Do	July 16, 1886		Sparrow		Grasshoppers.
Do	Oct. 13, 1886			Meadow mouse	Do.
Sandy Spring, Md	Jan. 28, 1887			do	
Do	Mar. 2, 1887			House mouse	Grasshopper.
Do	do			Mouse hair	
Do	do			House mouse	Remains of insects.
Do	do			Meadow mouse.	Do.
Do	do			White-footed mouse, house mouse.	
Do	do		Song sparrow		
Do	do				Do.
Do	Mar. 8, 1887		Song sparrow		15 crickets,
Do	Mar. 12, 1887				Grasshoppers, crickets, caterpillars, beetles.
Do	Mar. 18, 1887		Vesper sparrow		Larva.
Do	do			Meadow mouse.	Cricket, beetles.
Do	Mar. 24, 1887			House mouse	Cricket, larvæ.
Do	do				Empty.
Do	Apr. 1, 1887			Meadow mouse.	
Do	Apr. 8, 1887				Do.
Do	do			Meadow mouse.	Crickets, beetle, spider.
Do	Apr. 28, 1887			Mouse	Spider.
Do	May 13, 1887			Meadow mouse.	Grasshoppers, white grubs.
Do	June 23, 1887				Grasshoppers and crickets.
Do	Sept. 26, 1887				Grasshoppers, spider.
Do	Oct. 28, 1887				Grasshoppers, crickets, spider.
Do	Jan. 2, 1888			Shrew	Grasshopper.
Do	Feb. 22, 1888			Meadow mouse	
Do	Nov. 26, 1887				Grasshoppers, etc.
Chester County, Pa	Apr. 3, 1886			Meadow mouse.	Caterpillars.
Do	Dec. 29, 1886			Mouse	
Do	Dec. 28, 1886			Meadow mouse.	Crickets, grasshoppers.
Do	Dec. 29, 1886		Sparrow		
Do	Jan. 17, 1886		Song sparrow	White-footed mouse.	
Do	Feb. 8, 1886		Tree sparrow	do	
Do	Dec. 1, 1886			Meadow mouse	Grasshoppers, cricket, larvæ.
Do	Dec. 3, 1886				Beetle.
Do	Dec. 9, 1886		Junco		
Do	do		Feathers	Meadow mouse; 2 shrews.	
Do	Dec. 16, 1886		do		
Do	Nov. 26, 1886			Meadow mouse.	Crickets.

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Feb. 7, 1887			Meadow mouse	Crickets, caterpillars, spider.
Do	Jan. 12, 1887		Tree sparrow		
Do	Mar. 10, 1886				Empty.
Do	Jan. 6, 1885				Caterpillars, spider.
Do	Mar. 15, 1886				Empty.
Do				Meadow mouse	Grasshoppers, larvæ.
Do	Jan., 1887			do	
Do	do				8 larvæ, spider.
Do	Dec. 20, 1886			Meadow mouse	Larvæ.
Do	Jan. 10, 1887		Song sparrow		
Do	Feb. 9, 1886				Grasshoppers, beetles, larvæ.
Do					Remains of insects.
Do				Meadow mouse	
Do	Jan., 1887			House mouse	Grasshoppers, 10 larvæ.
Do				Meadow mouse	Grasshoppers, larvæ, beetle.
Do	Jan. 25, 1887			House mouse	Crickets, larvæ.
Do	do			Meadow mouse	5 grasshoppers, 5 larvæ, spider.
Do	do			do	
Do	Jan. 27, 1887			do	
Do	Jan., 1887		Tree sparrow	do	Caterpillar, crickets, spider.
Do	Feb. 1, 1887			White-footed mouse.	
Do	do			2 meadow mice	
Do	do				6 caterpillars, 6 grasshoppers, spider.
Do	Nov. 29, 1886				Insects.
Do	July 3, 1886				Do.
Do	Dec. 30, 1879		Meadowlark		
Do	Dec. 16, 1879		Junco	Mice	
Drayton Island, Fla	Feb. 20, 1885		Feather		Do.
Goshen, Pa	Jan. 12, 1881			Mice	
West Chester, Pa	Oct. 27, 1880				Do.
Chester County, Pa	Dec. 23, 1880		Meadowlark		Do.
Do	Jan. 12, 1881			Mice	
Do	Jan. 17, 1881			do	
Do	Sept. 24, 1880				Grasshopper.
Do	Feb. 16, 1880			Mice	
Delaware County, Pa	Jan. 30, 1880			do	
Chester County, Pa	Jan. 4, 1881			do	
East Bradford, Pa	Jan. 1, 1880				Insects.
Chester County, Pa	Nov. 20, 1879				Do.
Do	Aug. 25, 1876			Mice	
Do	July, 1870			Bat	
Do	Jan. 16, 1879		Junco	Mice	
Dixon County, Nebr	July, 1865			Mouse	8 locusts, 27 other insects.
Dakota County, Nebr	do			Gopher	38 insects.
Do	June, 1866	Quail			29 insects.
Do	July, 1866				34 insects.
Do	Aug., 1867			Rabbit	22 insects.
Cedar County, Nebr	do			Mice	47 locusts.
Pierce County, Nebr	July, 1869			Gopher	40 insects.
Sarpy County, Nebr	Sept., 1871			Mice	37 insects.
Do	June, 1872		Birds		43 insects.
Lancaster Co., Nebr	Sept., 1873				40 insects, frogs.
Hale County, Ala	Mar. 17, 1888				Grasshoppers, crickets.
Gainsville, Fla	Jan. 4, 1888				Remains of insects.
Do	Jan. 9, 1888				Larvæ and other insects.
Los Gatos, Cal	Dec. 7, 1887		Sparrow		
Do	Dec., 1887				Crickets.
Do	Jan. 19, 1885		Warbler		
Do	Dec. 31, 1887		Meadowlark; sparrow.		

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Apr. 2, 1888		Field sparrow		White grub, beetles, spider.
Chester County, Pa	Feb. 7, 1887				Caterpillar.
East Bradford, Pa	July 20, 1886			Meadow mouse.	
Chester County, Pa	Aug. 3, 1886				Grasshoppers.
Maplewood, N. J	Jan. 11, 1886		English sparrow		
Lookout Mountain, Tenn.	Mar. 31, 1882				Lizard.
Buena Vista, N. J	Oct. 11, 1885				Crickets.
Palatka, Fla	Feb. 19, 1881				2 lizards, beetles, grasshoppers.
Keene, N. H	July 10, 1886		Small bird		12 grasshoppers.
Do	July 14, 1886				Grasshoppers.
St. Helena Island, S. C.	Dec. 30, 1884		Ground dove		
New Orleans, La	Oct. 5, 1888				Dung beetles, dragon flies.
Bayou des Allemands, La.	Dec. 18, 1888				Dragon flies.
Brookville, Ind	Mar. 26, 1887			Mouse	
Do	do			2 meadow mice	
Rensselaer County, N. Y.	Apr. 7, 1879		2 small birds	Mouse	
Do	Sept. 3, 1885				Small black insects.
Do	June 6, 1888			Mice	
Albany County, N. Y.	June 13, 1881				Grasshoppers, bones.
Do	Apr. 11, 1882				Grasshoppers, caterpillars, other insects.
Do	Nov. —, 1882		Small bird		
Do	Mar. 9, 1885			Mice	Caterpillars.
Do	Sept. 21, 1886				Grasshoppers, other insects.
Do	Oct. —, 1887				Crickets.
Troy, N. Y	Dec. —, 1886				Empty.
Buffalo Gap, S. Dak	July 2, 1888				6 beetles.
Do	July 3, 1888				Grasshopper.
Do	do				2 grasshoppers.
Woodville, Minn	Apr. 9, 1888			Meadow mouse.	35 beetles.
East Hartford, Conn	Aug. 30, 1887				Beetles.
Custer, S. Dak	July 17, 1888			Mouse	Grasshopper, beetle.
Bozeman, Mont	Aug. 5, 1888				5 grasshoppers.
Do	do				7 grasshoppers, lepidopterous larva.
Do	do				30 grasshoppers, lepidopterous larva.
Do	Aug. 6, 1888				13 grasshoppers.
Do	Aug. 8, 1888				18 grasshoppers.
Do	do				22 grasshoppers.
Gallatin County, Mont	Aug. 17, 1888				25 crickets and grasshoppers, beetles.
Do	do				10 grasshoppers, beetles.
Hillsdale, Mont	Aug. 24, 1888				12 grasshoppers.
Gallatin County, Mont	Sept. 9, 1888				20 grasshoppers, 15 crickets.
Do	do				35 grasshoppers, 24 crickets, 1 dragon-fly, 2 spiders.
Madison River, Mont	Sept. 19, 1888				10 grasshoppers.
Fairmont, W. Va	Sept. 14, 1888				5 grasshoppers, 2 crickets.
Do	Sept. 19, 1888				6 grasshoppers, katydid, spider.
Do	Sept. 20, 1888				25 grasshoppers, 10 katydids, 10 crickets.
Sandy Spring, Md	Dec. 18, 1888			Meadow mouse.	14 crickets, 12 spiders, 13 grasshoppers.
Do	Dec. 28, 1888			do	2 lepidopterous larvæ.

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Dec. 28, 1888				12 lepidopterous larvæ, 8 crickets, spider.
Do	Dec. 29, 1888			House mouse	4 crickets, grasshopper.
Amityville, N. Y	Oct. 9, 1888				10 grasshoppers and crickets.
Flatbush, N. Y	April 17, 1888			Meadow mouse	15 lepidopterous larvæ, 2 spiders, grasshoppers, beetle.
Do	Sept. 28, 1888				5 grasshoppers.
Titusville, Fla	Aug. 14, 1888				Lizard, 3 grasshoppers, other insects.
Saint Lucie, Fla	Sept 29, 1888				Beetles, lepidopterous larvæ.
Fort Drum, Fla	Oct. 16, 1888				Cricket, beetle.
Do	....do				Spider, grasshopper.
Cisco, Tex	Sept. 17, 1888				3 large grasshoppers.
Eastland, Tex	Oct. 4, 1888				4 grasshoppers, 4 spiders.
Sandy Spring, Md	Jan. 19, 1889			Meadow mouse	1 lepidopterous larva, 2 crickets.
Do	Jan. 21, 1889			House mouse	
Do	Jan. 22, 1889			....do	
Lawrence, N. Y	Jan. 6, 1889				20 lepidopterous larvæ, cricket, spider, grasshopper.
Phoenix, Ariz	May 14, 1889				Grasshoppers, beetles.
Waterloo, Ind	Aug. 1, 1889				10 grasshoppers, beetle, katydid, spider.
San Francisco Mt., Ariz.	Aug. 2, 1889				12 grasshoppers, beetle.
Do	Aug. 3, 1888				8 grasshoppers.
Do	Aug. 4, 1889				Grasshoppers.
Do	Aug. 6, 1889				Do.
Do	Sept. 5, 1889				Grasshoppers, crickets.
Grand Cañon, Ariz	Sept. 14, 1889				Grasshoppers,
Greensboro, Ala	Sept. 29, 1889		Warbler		Large beetle.
Maryland	Oct. 13, 1889		Redwing blackbird.		
Raleigh, N. C	Oct. 1, 1885				Grasshoppers, beetle larvæ.
Do	Jan. 16, 1886		Carolina wren		
Do	Apr. 5, 1886				2 grubs, small beetles, fly.
Do	Apr. 12, 1886		Sparrow, warbler.		Fly.
Do	Sept. 13, 1886				Insects.
Do	Sept. 26, 1886				Grasshoppers.
Do	Oct. 9, 1886				Do.
Do	Dec. 23, 1886				Do.
Do	Feb. 14, 1887		Small bird		Insect remains.
Do	Feb. 16, 1887		....do		
Do	Apr. 8, 1887			Shrew	
Do	Aug. 26, 1887				Empty.
Do	Aug. 31, 1887				2 lizards, spider, insects.
Do	Sept. 1, 1887				Cricket.
Do	....do				Empty.
Do	Sept. 2, 1887				Grasshopper, katydid.
Do	Sept. 16, 1887				Grasshoppers.
Do	Sept, 22, 1887				Insects.
Do	Oct. 8, 1887				Grasshoppers.
Do	Dec. 29, 1887		Small bird		Do.
Do	July 31, 1888				Lizard, insects.
Do	Oct. 1, 1888				Grasshoppers.
Hale County, Ala	Nov. 28, 1889				25 grasshoppers, 5 crickets, 2 larvæ.

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sandy Spring, Md	Jan. 1, 1890				Grasshoppers.
Do	Jan. 2, 1890			2 house mice	2 grasshoppers, 1 cricket, 1 beetle.
Hale County, Ala	Dec. 28, 1889				2 spiders, 3 beetles, 6 grasshoppers, 10 crickets, larva.
Rockaway, N. Y	Sept. 21, 1889		Sparrow, warbler		Dragon flies.
Do	do				24 crickets.
San Francisco Mt., Ariz	Aug. 3, 1889				8 grasshoppers.
Greensboro, Ala	Feb. 10, 1890			Cotton rat	
West Point, N. Y	Apr. 25, 1877				Empty.
Circleville, Ohio	Dec. 4, 1880				Do.
Prescott, Ariz	Mar. 21, 1884				Moth, other insects.
Camp Verde, Ariz	Apr. 1, 1884				Empty.
Whipple Bar'acks, Ariz	Apr. 22, 1884				Insect remains.
Yavapai County, Ariz.	Apr. 26, 1884				Insects.
Camp Verde, Ariz	Apr. 29, 1884				Empty.
Do	do				Do.
Do	May 2, 1884				Do.
Do	do				Beetles, other insects.
Do	do				Empty.
Do	May 23, 1884				Insect remains.
Do	May 28, 1884				Do.
Do	July 18, 1884				Green grasshoppers.
Do	do				Empty.
Do	Sept. 11, 1884				Do.
Do	Sept. 15, 1884				Crickets.
Do	do				Do.
Do	do				Do.
Do	do				Do.
Do	Sept. 19, 1884				Empty.
Fort Apache, Ariz	Oct. 13, 1884				Insects.
Gila River, San Carlos, Ariz.	Oct. 17, 1884				Beetles, spiders.
Gila River, Arizona	Oct. 19, 1884				Insect remains.
Cataract Creek, Ariz	Nov. 11, 1884				Grasshoppers, butterfly.
Camp Verde, Ariz	Dec. 6, 1884				Empty.
Do	Dec. 17, 1884				Do.
Do	Feb. 9, 1885				Insect remains.
Do	do				Insect remains, spiders.
Do	Feb. 19, 1885				Empty.
Do	Mar. 4. 1885				Caterpillars.
Do	Mar. 20, 1885				Grasshoppers, caterpillars, and beetles.
Do	do				Insects.
Do	Nov. 9, 1885				Grasshoppers, other insects.
Do	Dec. 14, 1885				Empty.
Do	Apr. 4, 1886		Intermediate sparrow.		
Do	Sept. 14, 1886				Grasshoppers.
Do	Dec. 20, 1887				Insects.
Do	Jan. 11, 1888				Empty.
Do	Feb. 8, 1888				Do.
Do	Feb. 13, 1888				Do.
Clay County, S. Dak.	Aug. 29, 1889				35 crickets.
Bay St. Louis, Miss	Sept. 3, 1890				5 spiders, larva, katydid.
Morristown, N. J	Sept. 1, 1890				4 grasshoppers.
Portland, Conn	Sept. 10, 1890			Short-tailed shrew.	10 crickets, grasshoppers.
Union County, Ky	Apr. 26, 1890			Hair	White grub, 2 larvæ, spider, grasshopper.
Do	Oct. 4, 1890				15 crickets.
Do	Oct. 11, 1890				Empty.
Do	Oct. 25, 1890				Cricket and beetle remains.
Do	Nov. 5, 1890				8 grasshoppers, 2 crickets.

Table showing the results of examinations of 320 stomachs of the Sparrow Hawk (Falco sparverius)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Union County, Ky	Nov. 28, 1890				20 grasshoppers, 8 dung beetle larvæ.
Do	Dec. 5, 1890				1 grasshopper.
Sandy Spring, Md	Dec. 13, 1890			1 meadow mouse	
Wayne County, Mich	July 6, 1890				Beetle, cricket.
Do	Aug. 18, 1890				5 grasshoppers.
Sandy Spring, Md	Jan. 6, 1891			1 meadow mouse, 3 small short-tailed shrews.	
Do	do			House mouse, small short-tailed shrew.	
Do	Mar. 21, 1891			House mouse	
Gorham, Maine	Aug. 10, 1889				Grasshopper, cricket, and beetle remains.
Westbrook, Maine	Apr. 21, 1890			Mouse hair	7 caterpillars, 4 crickets, 5 small snakes.
Sandy Spring, Md	Mar. 13, 1892		Small sparrow		Cricket, grasshopper.
Do	Mar. 19, 1892		Tree sparrow	Small short tailed shrew.	
Portland, Conn	Mar. 7, 1891		English sparrow		2 grasshoppers, cricket.
Jacksonville, Ill	Mar. 26, 1892		Small bird		4 crickets, caterpillar.
Do	do			Meadow mouse	3 crickets.
Do	do			Mouse	Cricket.
Danville, Tenn	June 29, 1892		Small bird		Beetle.
Sandy Spring, Md	Jan. 6, 1892				Empty.
Do	Jan. 8, 1892			White footed mouse, small short tailed shrew.	
Do	do				Empty.
Ashton, Minn	May 14, 1892				Green snake, spider, insect remains.
Sandy Spring, Md	Mar. 30, 1892				12 crickets, beetle.
Do	Mar. 15, 1892		Small sparrow		3 caterpillars, 1 beetle.
Do	Jan. 11, 1891			2 house mice	
Do	do		Song sparrow	House mouse	
Do	do		2 sparrows		
Do	Jan. 16, 1892		Junco, and small sparrow.		
Do	Jan. 11, 1891			House mouse, meadow mouse	
Do	Jan. 14, 1891			Meadow mouse	
Do	do				Empty.
Do	Feb. 8, 1892		Tree sparrow		Caterpillar,
Do	Jan. 20, 1892		Junco	2 house mice	
Do	Jan. 14, 1891			House mouse	
Do	Mar. 15, 1892			2 house mice	Beetle; spider.
Provencal, La	May 31, 1892				Centiped, grasshopper.
Onaga, Kans	Apr. 20, 1892			Meadow mouse.	Grasshopper and caterpillar remains.

SUMMARY.—Of 320 stomachs examined, 1 contained a gamebird; 53, other birds; 89, mice; 12, other mammals; 12, reptiles or batrachians; 215, insects; 29, spiders; and 29 were empty.

AUDUBON'S CARACARA.

Polyborus cheriway.

Audubon's Caracara is a tropical species inhabiting northern South America, Central America, Mexico, and the southern United States, Florida, Texas, and Arizona. In the southern part of Texas, along the Rio Grande, it is more common in winter than during the warmer months, as individuals from the North join those that summer there. A closely allied species (*Polyborus tharus*) inhabits the whole of South America except the northern part, and a third one (*Polyborus lutosus*) is restricted to Guadalupe Island, Lower California.

The food of the Caracara more closely resembles that of the true vultures than that of the hawks proper. Like the vultures, it feeds greedily on dead animal matter of all kinds, seemingly having little preference for any particular sort. In the vicinity of slaughter-houses or about the carcasses of the larger animals, it may be seen in company with turkey buzzards devouring the bits of offal or carrion. The Caracara feeds also on lizards, snakes, frogs, young alligators, crabs, craw-fish, insects, and young birds. It is very partial to snakes and destroys large numbers of them and also feeds on the dead ones. Small mammals are eaten in considerable numbers. The crops of three halfgrown young which Mr. G. B. Sennett secured at Lomita, Tex., were filled with mice. Lieut. Couch states that it destroys large numbers of the Texas field rat (*Sigmodon berlandieri*). (U. S. and Mexican Boundary Survey, 1852, vol. II, part II, Birds, p. 4.) Mr. H. Nehrling informs us that in catching prairie dogs it hunts in pairs. It will sometimes attack animals as large as full-grown hares, as the following from Dr. J. C. Merrill demonstrates: I have seen a Caracara chase a jackass rabbit for some distance through open mesquit chaparral, and while it was in sight the bird kept within a few feet of the animal and constantly gained on it, in spite of its sharp turns and bounds. If one bird has caught a snake or field-mouse, its companions that may happen to see it at once pursue, and a chase follows very different from what is seen among the vultures. (Proc. U. S. Nat. Mus. vol. I, 1878, p. 153.)

The stomach of a specimen from Florida, which Audubon examined, contained the remains of a bullfrog, numerous hard-shelled worms, and a quantity of horse and deer hair. (Ornith. Biography, vol. II, p. 351.) In certain sections this bird is reported as feeding quite extensively on the ticks which infest the domesticated animals.

Waterfowl which have fallen out of reach of the gunner are taken whenever found. Mr. W. B. Barrows informs the writer that in one instance, while duck shooting in the Argentine Republic, a species closely allied to the one under consideration, attempted to carry off a duck which had been left lying on the surface of the water near him, and it was necessary to make considerable demonstration to scare it off, The Mexican Eagle, as this species is sometimes called, is an inoffensive bird, feeding for the most part on carrion and offal. Besides doing great service as a scavenger, it destroys numerous small rodents as well as injurious insects, for which it deserves protection.

The nest, which in most cases is a mere platform with a shallow depression, is a bulky structure, composed of small twigs, flags, reeds, coarse grass, or weed stalks, lined with fine grass, leaves, cotton, or Spanish moss. It is to be found in a great variety of situations according to the locality; on the plains where there is a scarcity of suitable vegetation it is placed in low bushes a few feet high, while along the river bottoms where large trees abound, it is located high up among the branches 40 or 50 feet from the ground. The eggs, which are from two to four in number, are deposited in the first half of April, in most if not all portions of its United States range. Both males and females assist in the duties of incubation. In most parts of the country the bird is considered shy, not allowing a person to approach within gun range, though in some of the southern countries it is as tame and unsuspicious as the vultures with which it associates.

The Caracara has the habit in common with some other birds of sitting for hours in an exposed place with ruffled plumage and half-spread wings exposed to the sun, for the purpose of absorbing the warmth of its rays. Unlike most of the birds of prey this species walks on the ground with ease and grace, and is able to catch agile insects by running after them. Unlike most birds of prey the Caracara frequently carries food in its beak while flying, though the larger morsels, as well as the nesting material, are usually held in the talons. The flight is strong and elegant and resembles closely that of the turkey-buzzard.

DESCRIPTION.

General plumage, black, with upper part of back and breast barred with white; lower portion of head, neck, chest, and feathers covering base of tail, soiled white; upper two-thirds of tail white, crossed by about thirteen to fourteen narrow bars.

Length: 20.50 to 25 inches (520 to 635^{mm}); extent, 47 to 49 inches (1194 to 1245^{mm}); wing, 14.50 to 16.50 inches (367 to 419^{mm}); tail, 8.75 to 10 inches (222 to 254^{mm}).

Table showing the results of examinations of 2 stomachs of Audubon's Caracara (Polyborus cheriway).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Magdalena, Mex	Nov. 2, 1889	....	....	....	Maggots; carrion.
Salt River, Arizona	Nov.19, 1886	....	....	Hair............	

SUMMARY.—Of two stomachs examined, one contained carrion and maggots and the other mammal remains.

OSPREY.

Pandion haliætus carolinensis.

[Plate 18—Adult.]

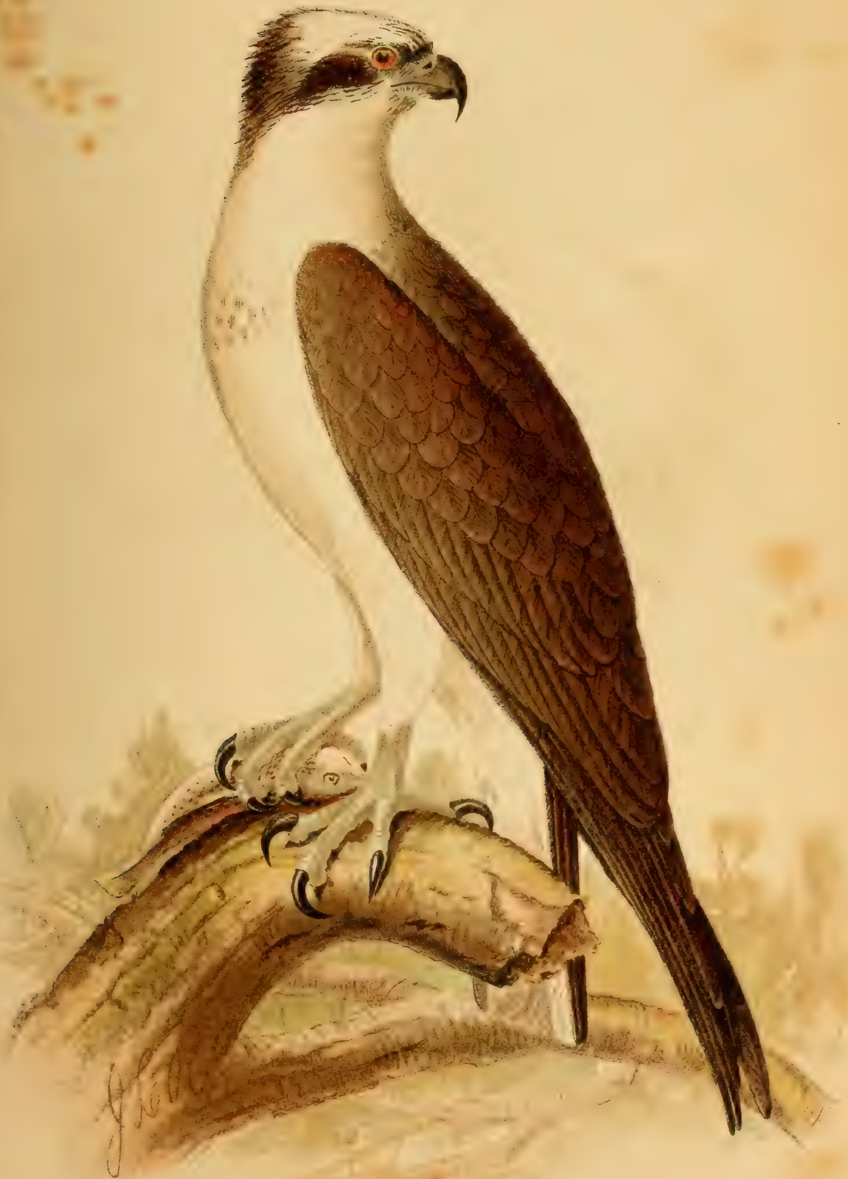
The Fish Hawk or American Osprey inhabits tropical and temperate America, ranging north to Labrador, Hudson Bay, and Alaska. It winters commonly in the southern United States, and in this region it breeds regularly in suitable localities north to the limit of its range. It arrives in southern New York in the latter part of March, and in Labrador and the north during the first week in May. The typical species, from which the American bird is scarcely separable, inhabits the whole of Europe, Africa, and northern Asia as far south as India and China.

The food of the Osprey consists entirely of fish which it captures, although in rare cases, when hard pressed, it has been known to pick up dead ones from the surface of the water. From the nature of its food, it must of necessity dwell near bodies of water of more or less extent, which are inhabited by an abundance of fish, especially such species as habitually swim in schools near the surface. In some localities, where there are extensive stretches of shallow water inhabited by an abundance of fish, the Fish Hawk often occurs in colonies of several hundred individuals, while in less favorable localities, a pair or so only are found.

The writer had exceptionally good opportunities in the lower Hudson Valley, New York, to study the bird while procuring its food, and in no instance was it observed to capture any fish except menhaden, herring, goldfish, or sunfish. When preparing to capture a fish this Hawk descends with great velocity at an acute angle, striking the water breast first, often disappearing under the surface in a mass of foam. The writer knows of one instance where an individual in striking at a fish in Croton Lake, New York, broke its wing. The persons observing its descent, wondering why it did not fly away, rowed up and discovered its condition.

The season as well as the locality has considerable to do with the kind of fish caught by the Osprey. It has been known to capture shad, catfish, perch, trout, etc. Wilson speaks of a shad a Fish Hawk captured and had partly eaten, which in that condition weighed six pounds. Nuttall states that fish weighing six to eight pounds are sometimes taken by the Osprey.

It has been said that the Fish Hawk will occasionally strike a large fish like a bass or sturgeon and, being unable to loosen its hold, is carried under and drowned. Large fish with dead Fish Hawks attached have been cast up by the waves on the beach. Although the Osprey feeds exclusively on fish, which in any form are of more or less value to man, with few exceptions, it feeds upon such species as are of the



AMERICAN OSPREY.

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least use as food. The fishermen, who are the ones most interested, welcome the appearance of this bird in spring, as it indicates the advance of schools of fish and, with few exceptions, they object to its being molested or killed. Fish Hawks are encouraged to nest in the vicinity of the house, not only for the picturesque appearance of the nest and birds, but also because it is believed that they keep off other Hawks which might do damage to the poultry.

The nest is occupied for years and, as new material is added each season, it soon becomes a bulky structure, sometimes measuring five feet in diameter. It is composed of large sticks, brush, rubbish of various kinds, including weed or cornstalks, and lined with soft material. such as seaweed, cedar bark, corn leaves, etc.; in exceptional cases it is composed almost wholly of kelp or other seaweeds. The nest is placed in trees, on telegraph poles, projections from cliffs, deserted buildings, or on the ground among the reeds or some eminence of the open sea beach. A very large proportion of the nests are situated in trees, usually on the top of the tallest in the neighborhood, and in plain sight from the surrounding country. The tree chosen is in most cases dead at the top; it is said that if a live one be selected, after a few years the portion near the nest dies from contact with the large amount of rubbish or the oily and saline deposits on it. In a few cases Fish Hawks have been reported to repair their nests before leaving for the south in the autumn.

The eggs, which are commonly two or three in number, are deposited at widely different dates in the northern and southern portions of its range. In Florida the full complement of eggs is deposited in January, in New Jersey and Maryland in May, and in Labrador and the North during the latter part of June.

The young are slow-growing and remain in the nest a long time after they are fully fledged before attempting to fly, and it is stated that the parents sometimes have to drive them from the nest. The male assists in incubation and also feeds his mate during this period.

The Fish Hawk is a gentle bird and never molests other species, even allowing the grackles and night-herons to build their nests and rear young in the interstices of its own nest. Unlike the Eagles it is a brave bird, defending its home against intruders and even attacking man when he molests its eggs or young.

The Fish Hawk is very much attached to particular trees to which it resorts to devour the fish captured; oftentimes these may be situated several miles from the body of water furnishing the food supply. The flight, like that of many of the heavier birds of prey, is ordinarily slow and labored, but when soaring or flying high in the air it is not surpassed by the Eagles.

DESCRIPTION.

Claws of the same length, narrower and rounder on under side. Above, plain dusky brown, tail more grayish, narrowly tipped with white, and crossed by about six or seven narrow bands of dusky; head, neck, and lower parts white, the chest sometimes slightly blotched with brown; sides of head with dusky stripe, top more or less streaked with dusky.

Length: 20.75 to 25 inches (527 to 635^{mm}); extent, 65 to 70.50 inches (1650 to 1790^{mm}); wing, 17 to 21 inches (432 to 533^{mm}); tail, 7 to 10 inches (178 to 254^{mm}).

Table showing the results of examinations of 12 stomachs of the Fish Hawk (Pandion haliœtus carolinensis).

Locality.	Date.	Poultry and game birds.	Other birds.	Mammals.	Miscellaneous.
Ercildoun, Pa	Oct. 5, 1889				Fish.
Bellefontaine, Ohio	Aug. 20, 1889				3 sunfish.
Do	do				Yellow perch.
West Point, N. Y	Oct. 1, 1873				Fishes.
Highland Falls, N. Y	May 4, 1874				Do.
Do	Nov. 25, 1873				Goldfish.
Do	Sept. 8, 1874				Empty.
Rockland County, N. Y.	Sept. 4, 1883				Fish.
Yavapai County, Ariz.	June 10, 1886				Hump-backed sucker.
Camp Verde, Ariz	Apr. 21, 1887				Suckers and bony-tails.
Plover Mills, Ont	Oct. 8, 1884				Mullet.
Morristown, N. J	Oct. 1, 1890				Tom cod.

SUMMARY.—Of 12 stomachs examined, 11 contained fish, and 1 was empty.

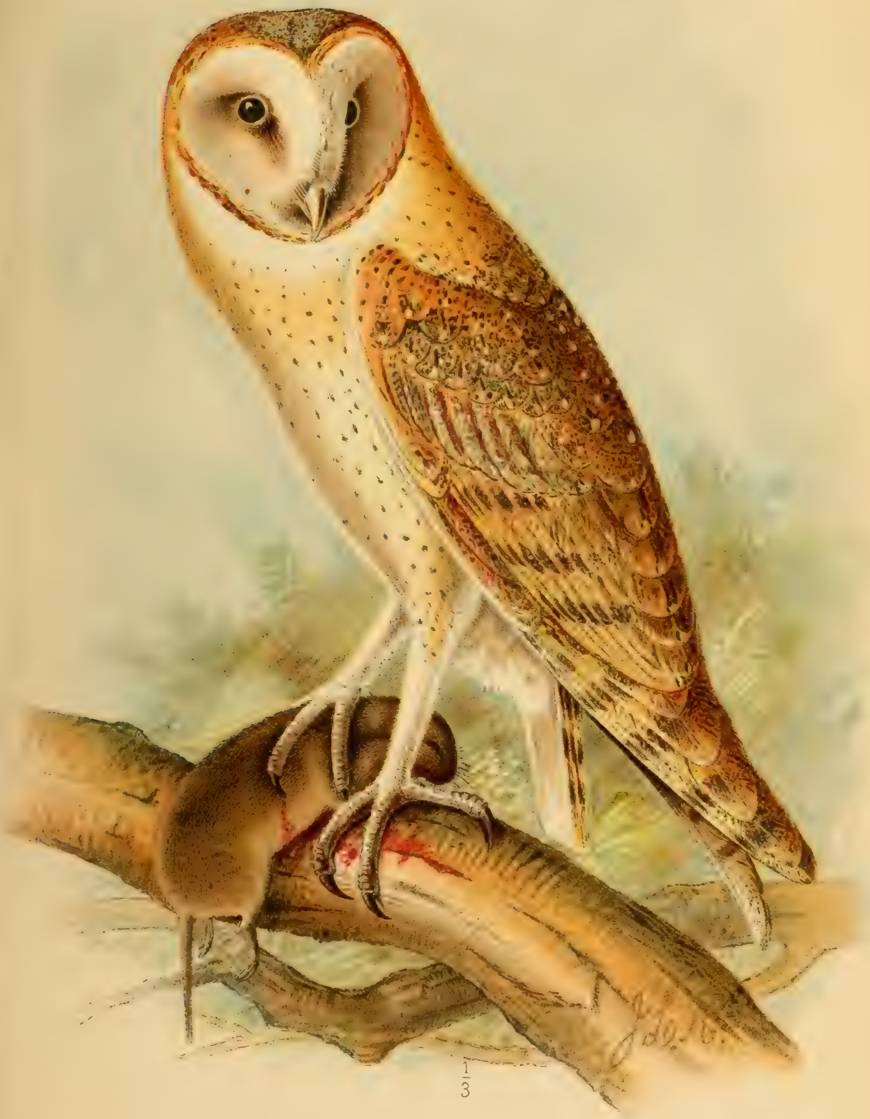
BARN OWL.

Strix pratincola.

[Plate 19—Adult.]

The genus *Strix*, to which our Barn Owl belongs, is chiefly tropical. Both in the northern and southern hemispheres, however it passes into the temperate zones, while the greatest extension of range from the tropics is reached in western Europe, where a species is found common in the British Isles. Closely related species occur in nearly all warm and temperate parts of the globe.

The bird which forms the subject of the present paper is found in the warmer parts of the United States and Mexico, while closely related geographical races occur in the West Indies, Central and South America. Along the Atlantic coast of the United States it is found casually as far north as southern New England and New York. From southern Virginia south and westward, including the southern tier of States, it is not numerous, although in California it is the most abundant Owl. On the Pacific coast it extends northward into Oregon, and in the Mississippi Valley reaches southern Minnesota, Wisconsin, and



BARN OWL

Strix pratincola. Bonap.

Michigan, and has been captured in southern Ontario. It migrates more or less in the northern part of its range and there is an appreciable increase in the number of individuals to the southward during the fall months.

Soon after the sun has passed the horizon and the first indications of twilight appear, this Owl emerges from its retreat and hurries to the hunting ground. It commonly resorts to the low meadow, prairie, and marsh lands, where its favorite prey abounds.

All testimony goes to show that the Barn Owl is one of the most beneficial of rapacious birds. Audubon says of the American species: "After long observation, I am satisfied that our bird feeds entirely on the smaller species of quadrupeds, for I have never found any portions of birds about their nests, not even the remains of a single feather in the pellets which they regurgitate, and which are always formed of the bones and hair of quadrupeds." (Ornithological Biography, vol. II, p. 406.)

Mr. W. B. Tegetmeier, in an article on the Barn Owl, says: "The utility of the owl is illustrated by Lord Lilford with a very amusing anecdote. He states that when he was a schoolboy he had a half-grown barn owl that he regaled on one occasion with as many mice as it would swallow. Eight in quick succession disappeared down the capacious gullet of the owl, the ninth followed all but the tail, which for some time hung out of the mouth of the bird, but the quick digestion of these raptores is well illustrated by the fact that in three hours the owl was ready for a second meal, and took four additional mice.

"If this is the performance of a single bird, the effect that the feeding of nests of six or seven young would have on the numbers of rats and mice in a district is self-evident. Lord Lilford says that he has seen a pair of barn owls bring food to their nest no less than seventeen times within half an hour. This rate, if continued for only four hours out of the twenty-four, would give (if we include the animals eaten by the old birds themselves) more than 150 'rats and mice and such small deer' destroyed daily for the support of one nest of owls. Is it surprising that vermin abound where their natural enemies have been exterminated by farmers, gamekeepers, and plumassiers?

"At this present time, when a plague of rats infest many districts of the country, I need make no excuse for quoting the experience of so sound and practical an ornithologist as the president of the B. O. U., on the utility of the barn owl." (Field, vol. LXXV, No. 1956, June 21, 1890, p. 906.)

Its food undoubtedly consists principally of several species of rodents which, from their great numbers and destructive habits, are a curse to the country they inhabit. The pouched gopher is one of the most destructive of this group, not only to vegetable and grain crops, but also to shade and fruit trees. The depredations in the latter case, which consists in the gnawing or entire removal of the roots, are the more serious as they often result in the total destruction of groves and orchards. In California the favorite food of the Barn Owl is a species of pouched gopher. All the stomachs and pellets which we have received from that State contained the remains of this animal. The following extract from a letter by Clark P. Streator, gives important testimony on the subject:

"In examining a large number of nests at all months of the year, I have found nothing but gophers [*Thomomys*], except on one occasion when there were one or two specimens of Brewer's blackbird. On further investigation I found a deposit of pellets of nothing but gopher hair and bones which had been ejected by the owls, and had accumulated in a few instances to the extent of two or three cubic feet in the trees in which they had lived. I also found that in the breeding season it was not uncommon to find six or more gophers, that were not eaten by the young, laying about the nest. I have found gophers in the nests at other times than the breeding season, but not in such abundance."

Prof. B. W. Evermann, who has had considerable experience with the bird in California, writes of its food as follows:

"Their food consists principally of the gopher (*Thomomys talpoides bulbivorus*) and the California ground squirrel (*Spermophilus grammurus beecheyi*), both of which are so destructive to growing crops and fruit trees on the Pacific coast. Other small mammals, particularly rabbits, birds, and insects go to make up its bill of fare. * * * This owl is not large, yet it must be a very strong and courageous bird, as evinced by the fact that I have often found in its burrows portions of the large jackass hare (*Lepus californicus*) or 'narrow-gauged mule,' as popularly known in California." (Ornithologist and Oölogist, vol. VII, 1882, pp. 97–98.)

In the East its food consists largely of mice and rats, which it destroys with as much energy as it does the gophers in the West. All the common species, including the meadow, house, and white-footed mice, as well as the common rat, are eaten with equal relish.

In certain portions of the Southern States where the cotton rat is very numerous and destructive to many of the crops, the Barn Owl, together with several other species of Hawks and Owls as well as a number of predatory mammals, feeds extensively on them. Four 'pellets' sent by Dr. W. C. Avery, from Greensboro, Ala., contained nothing except the remains of this mammal.

Audubon and Bachman, in their biography of the cotton rat, give the following: "This species supplies a considerable number of animals and birds with food. Foxes and wild-cats especially destroy thousands; we have observed minks coursing along the marshes in pursuit of them, and have frequently seen them with one of these Rats in their mouth. Marsh-hawks and several other species, may be constantly seen in the autumn and winter months sailing over the fields, looking out for the Cotton Rat. No animal in the Southern States becomes more regularly the food of several species of owls than this. The barred owl (*Syrnium* *nebulosum*) is seen as early as the setting of the sun, flitting along the edges of old fields, seeking to make its usual evening meal on it or carry it off as food for its young. We were invited some years since to examine the nest of the American barn owl (*Strix Americana*) in the loft of a sugar refinery in Charleston. There were several young of different sizes, and we ascertained that the only food on which they were fed was this Rat, to obtain which the old birds must have gone several miles." (Quad. N. A., vol. I, 1851, p. 231.)

The following extract from an article by Charles Dury is interesting not only in showing to what extent the Barn Owl feeds on rats, but also in pointing out its amicable relations with the domesticated pigeons:

"In October just past Mr. Biggs observed several large birds fly out of the town hall in Glendale. Three of these were killed and proved to be Barn Owls. Mr. Keys also killed one. On October 15 I received two specimens, male and female, that had been killed near Jones Station. In the stomach of one was a mouse, and in the other was an orthopterous insect, commonly called "Katydid" (*Cyrtophyllus concavus*). October 16, Mr. Clifford Allen went to the town hall and placed a ladder up to the tower and climbed up there. There were four owls on a beam looking down at him, and one of these he shot. In this specimen, which was a female, was a nearly grown rat, from which the head had been bitten and the body swallowed entire. Mr. Allen closed the trap-door leading to the tower, and on the 18th I went to Glendale to examine the place. When Mr. Allen went up four owls flew out, one of which was killed, a female. The stomach contained two mice. On going up into the tower I was astonished at the sight presented. The floor and ledges were covered with the cast-up pellets of the birds. It is well known to ornithologists that all raptorial birds swallow much indigestible matter, which is formed into balls in the stomach and afterwards cast up. These are called pellets. In this case they were by hundreds, and covered the floor several inches deep in places. I examined many of them, and found them made up entirely of the hair and bones of the smaller rodents, mostly mice. There must have been the débris of several thousand mice and rats. But the strangest part of the curious habitation was the flock of domestic pigeons that were living seemingly on intimate terms with the owls and, judging from the old pigeon nests, I presume the pigeons had actually nested and reared young there. This seems to show the food of this owl to be almost exclusively mice and rats, and proves it to be a species of the greatest economic value." (Journ. Cincinnati Soc. Nat. Hist., vol, VI, pp. 237, 238.)

Dr. John I. Northrop furnished the following note on the food of this Owl at Andros Island, Bahamas: "On March 25 we found two young ones not yet able to fly, and near by were the remains of the common rat of this island (*Mus rattus*). As is usual with this species, there was no nest, the birds resting on the ground. Around them for some distance the surface was covered with the rejected food balls, composed of the bones and hair of the rodent above mentioned, and, as no other bones were noticed, it is probable that the Owl's principal article of diet was rat." (Auk, vol. VIII, 1891, p. 75.)

The following in relation to the food of a family of owls found in a church steeple on Long Island is given by Mr. William Dutcher: "The floor on which they were was in a filthy condition, covered with pellets, and dead rats and mice in all stages of decomposition. There were also one young muskrat and some moles." (Auk, vol. III, 1886, p. 440.)

During the summer of 1890 a pair of Barn Owls occupied one of the towers of the Smithsonian building in the city of Washington, where they reared seven young. On June 28, the writer ascended to their home and found the young more than half-grown. The floor was strewn with pellets, and the nest, which was in one corner, was composed of a mass of broken-down ones. An examination of 200 of these pellets gave a total of 454 skulls. Of these, 225 were meadow mice; 2, pine mice; 179, house mice; 20, rats; 6, jumping mice; 20, shrews; 1, star-nosed mole, and 1, vesper sparrow (*Poocætes gramineus*).

Among other mammals on which it feeds more or less commonly, may be mentioned bats, shrews, and moles. Dr. Bernhard Altum, a number of years ago, examined 703 pellets disgorged by this species, and found a total of 2,551 skulls. Of these, 16 were bats; 3, rats; 930, mice; 1,579, shrews; 1, mole; 19, English sparrows, and 3, other birds. (Journal f. Ornithologie, 1863, pp. 43 and 217.)

Mr. W. B. Barrows, in a paper on birds of the Lower Uruguay (Auk, vol. I, 1884, p. 29), states that at night the deserted corridors of the college was one of this Owl's favorite hunting grounds for bats.

A stomach of a specimen from Louisiana, examined by Dr. F. W. Langdon, contained the remains of 4 shrews (*Blarina*) and 4 mice (*Hesperomys*). (Journ. Cincinnati Soc. Nat. Hist., vol. IV, p. 152.)

It is the exception for this owl to feed on birds, and probably it rarely does so except when other food is scarce. In one stomach only of those examined by the writer have the remains of birds been found.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Perodipus ordii.
Sitomys eremicus.
Sitomys americanus.
Onychomys melanophrys.
Arvicola riparius.
Arvicola pinetorum.
Blarina exilipes.
Blarina brevicauda.
Sigmodon hispidus.
Zapus hudsonius.
Thomomys umbrinus.
Mus decumanus.
Mus musculus.
Condylura cristata.
Perognathus.
Reithrodontomys.

BIRDS.

Molothrus ater.
Poocætes gramineus.
Passerina amœna.
Pipilo aberti.

Among the large number of skulls of different animals found by Dr. Altum only 22 belonged to birds, of which 19 were those of the worthless English sparrow.

The Barn Owl, like the other Owls, is fond of fish, and their remains have been found in its stomach. An interesting case in which the owl caught its own fish is cited by Seebohm: "Waterton records an instance, which he saw himself, of a Barn Owl dropping down into a pond like an osprey and flying off with a fish." (Hist. British Birds, vol. I, 1883, p. 150.) Insects are more or less often taken, for Prof. Aughey found a considerable number in all the specimens which he examined in Nebraska.

It breeds sparingly in all suitable localities throughout the territory which it inhabits, and in the Southwest, particular in Southern California, it breeds abundantly. Owing to the extensive range of the bird the nesting season varies widely. Thus, Prof. B. W. Evermann found full complements of eggs at Santa Paula, Cal., in February, while in southeastern Texas, H. Nehrling found eggs in the early part of May; in Florida, Maynard found that it nested in March, April, and May. Except in the more northern parts of its range, where it breeds as late as June, it is probable that the majority of eggs are deposited in March.

In Europe the Barn Owl breeds more commonly in old ruins, church belfries, cavities in the abutments of bridges, and old walls. In America, where few suitable ruins and open belfries exist, such nesting sites are comparatively uncommon. The most usual nesting site in the West is in cavities in the sides of gullies, which in California are called *barrancas*. These barrancas are nothing more than miniature cañons, formed in the rainy season by torrents of water washing away the earth. The walls are nearly perpendicular and contain innumerable cavities. Some authors think the birds partially excavate the nesting site, but this seems to be doubtful, and if the holes are enlarged by artificial means it is probably by some rodent. Crevices in rocky cliffs are also used, as well as hollows in stubs and trees, and on one occasion Prof. Evermann found a pair using the deserted nest of a crow (Ornithologist and Oölogist, vol. VII., April, 1882, p. 109). This instance of the use of a deserted nest is the only one which has come to the writer's notice, and the habit must be extremely rare. In the East the habit of nesting in buildings is more frequent than elsewhere in the United States, though various other locations are also chosen. Barns, churches, cupolas of town halls, and ice-houses are used, and in the city of Washington a pair breeds in one of the towers of the Smithsonian Institution.

The nest proper when placed in a cavity, whether of a tree or a bank, is usually nothing more than a few feathers from the parent bird, together with the accidental material found in the hollow. If placed in a building it is more bulky, and is composed generally of the miscellaneous rubbish which collects in such places, combined with the remains of the broken pellets dropped by the birds. The number of eggs in a nest is usually from four to seven, though Prof. Evermann found sets containing as many as ten in Ventura County, Cal. Undoubtedly, as with other species, the number of eggs depends upon the food supply, the number being greatest where food is most abundant.

The period of incubation is from three to three and one-half weeks. As a bird will occasionally begin to set soon after the first egg is deposited and as eggs are laid on alternate days, the last one will not hatch until two weeks after the first. This habit accounts for the great difference in size in individuals of the same family. When the cavity containing the nest is large enough both birds usually occupy it.

Unlike most of our Owls, which are hardy northern species, enduring very low temperatures with impunity, the Barn Owl seems to be unable to withstand much cold weather; in all probability it sometimes perishes in the northern part of its range, when overtaken by severe weather, before being able to migrate.

This Owl is one of the most distinctively nocturnal of the tribe, but like all the others it can see perfectly well in the brightest daylight, when for any reason it is required to leave its retreat. It usually sleeps during the day, sitting upright in a dark nook or crevice, in the shadow of a bridge or among the dense foliage of some grove or reedy marsh. Except in the breeding season the Barn Owl may be considered more or less gregarious, families of seven or ten individuals being often found together, and colonies of fifty or more have been observed.

Besides its shrieking or screeching note, which is heard more often in spring, it has a nasal one which has been termed a 'snore.' The peculiar and almost ludicrous expression of the physiognomy of this bird, as it sits upright with half-closed eyes, has suggested to the minds of many a fanciful resemblance to a monkey; hence the origin of the name 'Monkey-faced Owl,' which is a common appellation for the bird in many parts of the country, especially Florida. In this State the credulous have been led to believe that certain birds with monkeys' heads exist in the remote recesses of the Everglades. The plumage of this bird is even softer and more silky than that of the other Owls, and its flight, if possible, is more silent.

DESCRIPTION.

Facial disk not circular, but somewhat triangular. Middle and inner claws of equal length; inner edge of middle claw jagged; wing long, reaching beyond tail when folded; tail about half the length of wing.

Color.—Above, ochraceous-yellow, more or less marbled with white or ashy, and speckled with black, and sometimes with white spots. Below, varying in every degree from silky white to bright tawny, dotted with black spots. Eyes small, black.

Length: 15 to 20 inches (381 to 508^{mm}); extent, about 45 inches (1143^{mm}); wing, 13 to 14 inches (330 to 355^{mm}); tail, 5.75 to 7.5 inches (145 to 190^{mm}).

Table showing the results of examinations of 39 stomachs of the Barn Owl (Strix pratincola).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chickamauga, Tenn	Nov. 27, 1885		Cowbird, sparrow.		
Chester County, Pa	May 21, 1886			Meadow mice.	
Do	Dec. 8, 1886	Pigeon			
Dixon County, Nebr	Aug. —, 1867			Mouse	39 locusts, 22 other insects.
Dakota County, Nebr.	July —, 1868				55 insects.
Lancaster Co., Nebr	June —, 1872			Mouse	40 insects.
Gainesville, Fla	Feb. 4, 1887			2 cotton rats, 2 shrews.	
Washington, D. C	July 5, 1888			1 meadow mouse, 2 jumping mice.	
Poway Valley, Cal	Mar. 17, 1888			1 pocket gopher.	
Do	do			2 pouched gophers.	
San Bernardino, Cal	Jan. 7, 1886			1 pocket gopher.	
Do	do			1 pocket mouse, 8 harvest mice, 1 white-footed mouse.	
Do	do			1 pocket rat, 2 small mammals.	
Do	do			1 pocket gopher.	
Do	Jan. 13, 1886			1 wood rat, 1 mouse.	
Do	do			1 pocket rat.	
Do	do			1 small rodent.	
Do	May 10, 1886			1 pocket gopher.	
Riverside, Cal	May 21, 1886			Small mammals, 1 harvest mouse.	
Do	do			1 pocket gopher.	
San Bernardino, Cal	May 22, 1886			2 meadow mice.	
Woodland, Cal	May 24, 1886			2 field mice.	2 grasshoppers, 3 other insects.
Rockville, Md	Nov. 1, 1889			Jumping mouse, meadow mouse, white-footed mouse.	
Sandy Spring, Md	Nov. 2, 1889			2 meadow mice.	
Newport, N. C	Nov. 7, 1889				Empty.
Camp Verde, Ariz	May 31, 1884			Kangaroo rat, white-footed mouse.	
Do	July 27, 1885		Lazuli finch	Small rodents.	
Do	July 29, 1885				Do.
Do	do		Abert's towhee	Small mammals.	
Do	July 30, 1885			Pocket gopher.	
Do	Dec. 16, 1885				Do.
Do	Oct. 3, 1887			Grasshopper mice.	
Morristown, N. J	Oct. 1, 1890			Meadow mouse.	
Little Creek, Del	Dec. —, 1891				Do.
Leesville, Conn	Jan. 11, 1891				Do.
Washington, D. C	Dec. —, 1891			4 house mice.	
Do	Apr. 5, 1891			3 meadow mice, 3 shrews.	
Kern River, Cal	July 4, 1891				Do.
Do	do				Do.

SUMMARY.—Of 39 stomachs examined, 1 contained poultry; 3, other birds; 17, mice; 17, other mammals; 4, insects, and 7 were empty.

LONG-EARED OWL.

Asio wilsonianus.

[Plate 20—Adult.]

The Long-eared Owl inhabits the whole of temperate North America ranging south to the table lands of Mexico. In the North it is plentiful in the Saskatchewan and Hudson Bay districts, and Richardson observed it as far as the sixty-first parallel and thought it extended to the limit of trees. Along the Atlantic coast it is found from Nova Scotia to Florida, and is more or less common in the intervening country westward to the Pacific. Mr. Henshaw thinks it is the most common species in Utah, and Mr. Ridgway found it in almost every willow copse from the coast of California eastward into Nevada. There are no records from central and northern Alaska, though probably it occurs commonly in the southern part of the Territory. A representative species is found throughout the temperate parts of Europe and Asia, as well as northern Africa.

The Long-eared Owl is one of our most beneficial species, destroying vast numbers of injurious rodents and seldom touching insectivorous birds. The birds killed by it are mostly seed-eating species, which do not benefit the agriculturist to any great extent. As this Owl is readily destroyed, it is the one that suffers most when short-sighted legislators enact laws for the destruction of birds of prey. It will be seen from the following testimony that it is both cruel and pernicious to molest a bird so valuable and innocent as the one under consideration.

Audubon says: "It preys chiefly on quadrupeds of the genus *Arvicola* and in summer destroys many beetles." (Ornith. Biography, vol. IV, p. 573.)

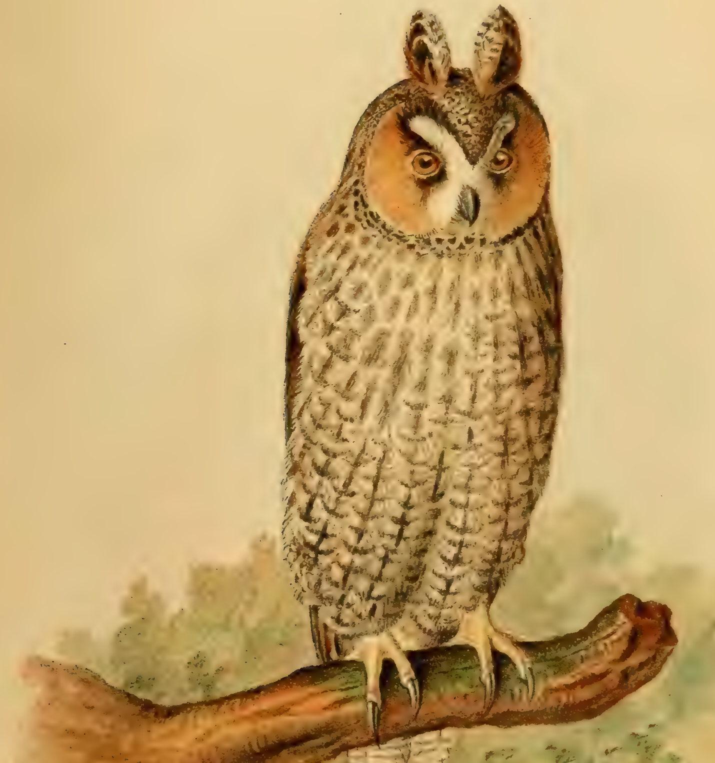
Nuttall remarks: "Besides mice and rats this species also preys on field mice, moles and beetles." (Land Birds, 1832, p. 131.)

Mr. H. W. Henshaw says: "Their food consists almost exclusively of field mice, of which they kill vast numbers, a fact which should earn them the protection of the farmer." (Report of the Chief of Engineers, U. S. A., 1877, p. 1311.)

Mr. Townend Glover says: "The stomach of one specimen of the Long-eared Owl in the collection contained the skulls and bones of at least 8 field mice, and therefore, when about barns and granaries, these birds must be very useful." (U. S. Agl. Rept., 1865, p. 37.)

Capt. Charles E. Bendire, writing from Camp Harney, Oregon, states: "Their food consists principally of mice and the smaller rodents." (Ornithologist and Oologist, vol. VI, 1882, p. 82.)

Dr. B. H. Warren gives the following: "I have examined the stomachs of twenty-three Long-eared Owls and found that twenty-two of them had fed only on mice; the other examination made of a specimen taken late in the spring showed some beetles and portions of a small bird." (Birds of Pennsylvania, 1888, p. 107.)



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AMERICAN LONG-EARED OWL.

Asio wilsonianus (Less.)

This Owl is preëminently a mouser, but it also destroys some insects and probably small batrachians and reptiles.

In April, 1888, at Munson Hill, Va., a thickly wooded country about 8 miles from the city of Washington, the writer collected some fifty or more pellets under a tree where one of these Owls had roosted all winter. From this mass were gleaned 176 skulls or parts of skulls, representing the following species: 95 meadow mice (*Arvicola riparius*); 19 pine mice (*A. pinetorum*); 15 house mice (*Mus musculus*); 5 white-footed mice (*Sitomys americanus*); 3 Cooper's mice (*Synaptomys cooperi*); 23 little short tailed shrews (*Blarina exilipes*); 3 short-tailed shrews (*B. brevicauda carolinensis*); and 13 birds, of which 11 were sparrows, 1 a bluebird, and the other a warbler. It might be stated in this connection that the remains of Cooper's mice found on this occasion was the first intimation that the species occurred anywhere in the vicinity.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Perognathus penicillatus.
Mus musculus.
Sitomys americanus.
Evotomys gapperi.
Arvicola riparius.
Arvicola pinetorum.
Synaptomys cooperi.
Blarina b. carolinensis.
Blarina exilipes.
Sorex.

BIRDS.

Spinus tristis.
Spizella monticola.
Junco hyemalis.
Melospiza georgiana.
Melospiza fasciata.
Dendroica coronata.
Regulus satrapa.
Turdus swainsoni.
Sialia sialis.

The Long-eared Owl breeds in suitable localities throughout its range. Its nest is usually a remodeled nest of some bird or mammal, more often of the hawk, crow, magpie, and heron, and occasionally that of the squirrel. The remodeling commonly consists in making the top more or less even and in the addition of a few evergreen twigs, leaves, or feathers as a lining. The situation, of course, varies; some nests are in high trees, others in low trees and bushes, while a few have been found on the ground. But one instance of this species nesting in hollow trees has come to our knowledge, and this is related by Capt. Bendire as occurring at Fort Lapwai, Idaho, and is as follows:

"Two pairs of birds took up their quarters in an old Magpie's nest, and two others in hollow cottonwood trees. In one of the last cases a Red-shafted Flicker had excavated a hole directly over the one occupied by the Owls, and the two entrance holes, although on different sides of the stump, which was only about twelve feet high, were not over two feet apart. These birds seemed to live harmoniously together." (Ornithologist and Oologist, vol. VI, 1882, p. 81.)

Like many other birds of prey its nesting habits have been modified in some parts of the West by the absence of trees, for in many places it breeds in common with other species in the precipitous cliffs bordering the cañons. Whether it ever builds its own nest, especially those which are found on the ground or in the cliffs, is an open question. The eggs are from three to six in number, five being the most common, in the experience of the writer. Throughout the middle of its range the eggs are deposited usually from the latter part of March to the first week in April, and toward the northern limit it is probably the last of April before the sets are completed. In the southern part of California it nests considerably earlier, as full sets of eggs are found by the lat-latter part of February. Capt. Bendire states that the period of incubation is about three weeks. In June the young leave the nest and may be seen with the old birds in some dark retreat. While the female is sitting the male is usually near by, either on the edge of the nest beside her, on a branch of the same or an adjoining tree or occasionally on the ground underneath.

This species, like the Screech Owl, is nocturnal in its habits, and differs from the Short-eared Owl in never hunting during the daytime. It usually spends the day in some evergreen woods, thick willow copse, or alder swamp, although rarely it may be found in open places. On one occasion in October, in the vicinity of Boston, the writer, in company with Messrs. John H. Sage and H. A. Purdie, found one of these birds sleeping among some small deciduous trees which had lost most of their leaves.

Throughout the eastern part of the United States, solitary birds, or less frequently a pair, are usually found during the winter months, while it is common to find small bands or families of six or seven together in summer and early fall. In certain parts of the West the species is gregarious and often as numerous as the Barn Owl.

Mr. H. W. Henshaw says: "It seems to be a habit with this species in the West to congregate together and form colonies, often made up of a large number of individuals. I have, however, noticed this to be most frequently the case in regions where timber was scarce, and doubtless this lack of places suited to the necessities of their nature, which requires them to pass the hours of daylight in some dark, secluded retreat, furnishes the reason for this apparent sociability. In Grass Valley, Utah, I thus found at least a dozen individuals together in a small grove of cedars, and nearly every tree contained one of their nests, rudely made of coarse sticks, while some supported two or three. The birds were roosting on the low branches in the darkest portions of the clump, and they were generally so well concealed that I saw them only as they dashed hurriedly out when I was close upon their retreats" (Explor. West of the 100th Merid., Wheeler, vol. v, 1875, p. 403). And Capt. Bendire speaks of seeing some fifteen or more on a single mesquit tree, near Rillito Creek, Arizona.

Although quiet during the day, and apparently indisposed to venture into the strong light, when started it is able to thread its way rapidly through the most intricate passages and to evade obstructions, demonstrating that its vision is in no way defective. The bird is not wild, and will allow itself to be closely approached. When conscious that its presence is recognized it sits upright, draws the feathers close to the body and erects the ear tufts, resembling in appearance a piece of weather-beaten bark more than a bird. It makes a very gentle and interesting pet, and will afford great amusement by its numerous antics. An individual which the writer once had would allow itself to be dressed in a doll's hood and shawl by the children. When too roughly handled it would fly to the top of a door, though in a few minutes it would return to them and appeared to be interested in all the details of their play. Mr. F. H. Carpenter (Ornithologist and Oologist, vol. VIII, 1883, p. 62) mentions a peculiar habit in one of these Owls which he reared from the nest. Seeing a basket of chaff which it had learned to know contained young mice, the bird would draw each of its claws through its bill, and, as soon as the material was placed on the floor of the apartment, would fly down and begin the search, scratching after the manner of a hen, at the same time keeping up a contented preening noise.

Like the other Owls, its flight is slow and wavering, but in common with them it is buoyant and devoid of any appearance of heaviness. The note of this Owl is said by some to resemble the noise made by kittens, while others state it is like the barking of small dogs.

DESCRIPTION.

Ear tufts conspicuous, containing eight to ten feathers, and about as long as middle toes with claw.

Color.—Above dusky, mottled with gray, tawny, and blackish; below grayish white with confused marbling of brown, black, and tawny, many feathers with a median longitudinal dusky stripe which gives off transverse bars. Feet and legs tawny and unspotted.

Length: 13 to 16 inches (330 to 406^{mm}); extent, about 39 inches (990^{mm}); wing, 11 to 12 inches (280 to 305^{mm}); tail, 5.50 to 6.50 inches (140 to 165^{mm}).

Table showing the results of examinations of 107 stomachs of the Long-eared Owl (Asio wilsonianus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Coahuila Valley, Cal	Apr. 1, 1886			2 pocket mice	
Washington, D. C	Mar. 27, 1887		Song sparrow	Meadow mouse	
Sheepshead Bay, L. I., N. Y	Nov. 2, 1886		Junco, kinglet	do	
Washington, D. C	Mar. 16, 1887				Empty.
Sandy Spring, Md	Mar. 8, 1887				Do.
Do	Mar. 12, 1887			Meadow mouse	
Do	Mar. 18, 1887				Do.
Do	Nov. 19, 1887				Do.
Do	Jan. 7, 1888			2 meadow mice	
Chester County, Pa	Jan. 11, 1887			Meadow mouse, 3 house mice.	

Table showing the results of examinations of 107 stomachs of the Long-eared Owl (*Asio wilsonianus*)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa	Nov. 20, 1886			Meadow mouse	
Do	Dec. 11, 1886			do	
Do	Jan. 28, 1887			2 meadow mice	
Do	do			White-footed mouse, meadow mouse.	
Do				Meadow mouse.	
Do	Dec. 13, 1886			White-footed mouse, 2 meadow mice, shrew.	
Woodstock, Conn	June, 1887			4 meadow mice.	
Boston, Mass	Oct. 13, 1887		Sparrow, warbler.	Meadow mouse.	
Montgomery Co., Pa	Dec. 26, 1887			do	
Sing Sing, N. Y	Apr. 29, 1880		Goldfinch, 2 sparrows.	Mouse	
Do	do			2 mice	
Do	do		Small bird	do	
Chester County, Pa	Nov. 25, 1886			Mice	
Do	Nov. 10, 1878			do	
Do	Dec. 30, 1884			do	
Westtown, Pa	Feb. 23, 1879			do	
Do	do			do	
Do	do			do	
Chester County, Pa	do			do	
Do	do			do	
Do	do			do	
Do	do			do	
Do	Nov. 22, 1880			do	
Do	Dec. 5, 1879			do	
Do	Feb. 25, 1880			do	
Do	do			do	
Do	do			do	
Do	do			do	
Do	do			do	
Dakota County, Nebr	July —, 1865			Rabbit	Few insects
Elmira, N. Y	Aug. 5, 1885			Field mice	
Do	Aug. 12, 1885			do	
Do	Oct. 13, 1886			do	
Do	do			do	
Nichols, N. Y	July 4, 1887				Empty.
Tioga, Pa	Sept. 2, 1887			Field mice	
Elmira, N. Y	Dec. 21, 1887	Quail			
Poway Valley, Cal	Apr. 5, 1888			Small mammal	
Woodville, Minn	Apr. 6, 1888			2 meadow mice	
Jefferson River, Mont	Sept. 16, 1888				Do.
Washington, D. C	Nov. 25, 1888			White-footed mouse.	
Fairfax County, Va	Dec. 16, 1888			House mouse, white-footed mouse.	
Ogden, Utah	Oct. 12, 1888			2 meadow mice	
Hollis, Queens County, N. Y.	Jan. 4, 1889			Meadow mouse	
Lake Grove, Suffolk County, N. Y.	May 30, 1889			White-footed mouse.	
Do	do			do	
Do	do			White-footed mouse, meadow mouse.	
Toronto, Canada	Oct. 15, 1889			Meadow mouse, 2 shrews.	
Morristown, N. J	Apr. 5, 1886			Meadow mice	
Do	do		Song sparrow	do	
Fort Hamilton, Long Island, N. Y.	Oct. 9, 1880			Mouse	
Newtown, Conn	Oct. 29, 1880			4 mice	
Indiana	Dec. 23, 1883			Mouse	
Litchfield, Conn	July 1, 1885			3 meadow mice	
Sheepshead Bay, Long Island, N. Y.	Nov. 2, 1886		Sparrow	Meadow mouse	
Story County, Iowa	Oct., 1883			3 mice	
Rensselaer County, N. Y.	Dec. 12, 1878				Do.
Do	Nov. 28, 1884			3 mice	
Do	Oct. 3, 1886			2 mice	
Saratoga County, N. Y.	Dec. 19, 1879			do	
Washington County, N. Y.	Oct. 18, 1880		Sparrow	Mouse	

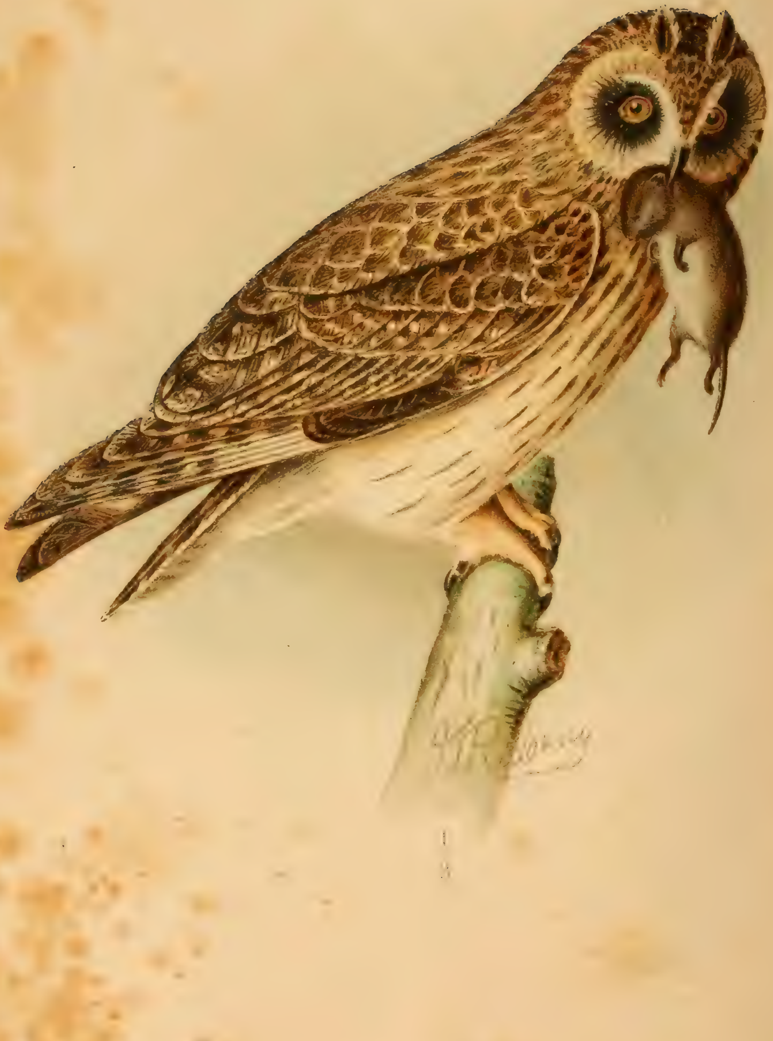

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Table showing the results of examinations of 107 stomachs of the Long-eared Owl (Asio wilsonianus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Albany County, N. Y.	Nov. 20, 1887			Squirrel, mice	
Rensselaer County, N. Y.	May 6, 1889		Sparrows		
Gaylordsville, Conn	Oct. 15, 1889		Snowbird, warbler.		
Ercildoun, Pa	Dec. 31, 1889			2 meadow mice	
Long Island City, N. Y	Oct. 29, 1888			do	
Do	Oct. 16, 1888		Song sparrow, 2 other sparrows.		
Huntington, N. Y	Jan. 23, 1890			2 meadow mice, 1 pine mouse.	
Sandy Spring, Md	Mar. 14, 1890				Empty.
Do	do		Sparrow		
Do	May 9, 1890			2 meadow mice	
Do	do			do	
West Point, N. Y	Apr. 9, 1880				Do.
Do	June 23, 1880				Do.
Circleville, Ohio	Dec. 7, 1881				Do.
Camp Verde, Ariz	Jan. 2, 1886				Do.
Do	Feb. 20, 1886				Do.
London, Ontario	Oct. 16, 1890		Song sparrow	2 meadow mice, 1 red-backed mouse.	
Selden, Suffolk County, N. Y.	May 30, 1889			Meadow mouse, pine mouse.	
Keokuk, Iowa	Oct. 28, 1888			Mouse	
Do	Nov. 7, 1889			4 mice	
Sandy Spring, Md	Nov. 28, 1890			3 meadow mice	
Do	do			Mouse	
Do	do			do	
Morristown, N. J	Oct. 22, 1890			3 meadow mice	
Horse Hill, N. J	Oct. 27, 1890		Thrush		
Do	Nov. 5, 1890			2 meadow mice	
Washington, D. C	Feb. 2, 1891			Meadow mouse	
Sandy Spring, Md	Dec. 31, 1890				Do.
Do	Nov. 24, 1891				Do.
Lancaster County, Pa	Dec. 16, 1891			2 meadow mice	
Do	do			2 meadow mice, 1 white-footed mouse.	
Do	Dec. 17, 1891			Pine mouse	
Do	Nov. 10, 1891		Tree sparrow	Meadow mouse	
Do	Nov. 16, 1891			do	
Do	Dec. 17, 1891			3 meadow mice	
Rutland, Vt	May 23, 1892			Mouse	Fragments of egg shell.

SUMMARY.—Of 107 stomachs examined, 1 contained a game bird; 15, other birds; 84, mice; 5, other mammals; 1, insects and 15 were empty.

SHORT-EARED OWL.

Asio accipitrinus.

[Plate 21—Adult.]

The Short-eared Owl is a bird of extended distribution, ranging over the greater part of both hemispheres. In Africa it has been found as far south as Abyssinia in winter. It has not been recorded from Australia. In a northerly direction it reaches the southern part of the Arctic regions at about the 69th parallel, from whence southward it probably breeds more or less commonly in favorable localities throughout its range, though as a summer resident it is rare in most parts of eastern United States.

The food of this Owl consists largely of mice and other small mammals. A number of species of insects, birds, and reptiles also may be mentioned as occasionally contributing to its fare. Fully 75 per cent of the stomachs examined in the Department of Agriculture contained mice. The remains of as many as six of these little mammals were found in one stomach, and several contained three or four each. Prof. F. E. L. Beal reported finding nothing but mice in the stomachs of a pair which he killed in Story County, Iowa. They were shot in an artificial grove swarming with small birds. Mr. Austin F. Park, of Troy, N. Y., in a report on the food of Hawks and Owls, which he kindly sent to this Department, mentions mice and no other kind of food as found in the stomachs of this species.

Of the other mammals which this Owl feeds upon may be mentioned shrews, gophers, and sometimes small rabbits. Shrews are not uncommon in the stomach contents. Dr. J. C. Merrill, in mentioning the food of this bird at Fort Klamath, Oregon, says: "In one specimen a pellet ready for regurgitation contained ten nearly perfect skulls of a shrew, a species of which, and field mice, were nearly always found in the stomachs." (Auk, vol. v, April, 1888, p. 146.)

Unfortunately we have been unable to procure stomachs of this Owl from the western plains which are infested with ground squirrels and gophers, hence we do not know to what extent it feeds upon these rodents. Mr. G. F. Brenninger, of Beattie, Kans., states (Ornith. and Oologist, XI, 1886, 167) that the food of this species consists chiefly of mice, insects and ground squirrels. It does not feed as extensively on insects as either the Barred or Screech Owls, but there are reports enough on the subject to show that grasshoppers, crickets, and beetles at times form a considerable part of its food. It is quite exceptional for this Owl to feed upon birds. Out of ninety stomachs examined by us at the Department ten contained bird remains.

A notable violation of its usual habit of feeding upon mice may be quoted from Mr. William Brewster, as follows: "A small colony of these birds had established itself upon a certain elevated part of the island [Muskegat], spending the day in a tract of densely matted grass. Scattered about in this retreat were the remains of at least a hundred Terns, that they had killed and eaten. Many of these were fresh, while others were in every stage of decomposition, or dried by the sun and wind. In each case the breast had been picked clean, but in no instance was any other portion disturbed. Every day at a certain time these Owls sallied forth in search of fresh prey. We used regularly to see them about sunset, sailing in circles over the island or beating along the crests of the sand hills. They were invariably followed by vast mobs of enraged Terns, which dived angrily down over the spot where the Owl had alighted, or strung out in the wake of his flight like the tail of a comet. The Owl commonly paid little attention to this unbidden following, and apparently never tried to seize his persecutors while on the wing, but on several occasions we saw a sitting bird pounced upon and borne off. Sometimes in the middle of the night a great outcry among the Terns told where a tragedy was being enacted." (Bull Nutt. Ornith. Club, vol. IV, 1879, p. 19.)

The following important evidence of the economic value of the Short-eared Owl is from the fourth edition of Yarrell's British Birds (vol. IV, p. 165): "Undoubtedly field mice, and especially those of the short-tailed group or voles, are their chief objects of prey, and when these animals increase in an extraordinary and unaccountable way, as they sometimes do, so as to become extremely mischievous, owls, particularly of this species, flock to devour them. Thus there are records of 'a sore plague of strange mice' in Kent and Essex in the year 1580 or 1581, and again in the county last mentioned in 1648. In 1754 the same thing is said to have occurred at Hilgay, near Downham Market, in Norfolk, while within the present century the Forest of Dean, in Gloucestershire, and some parts of Scotland have been similarly infested. In all these cases owls are mentioned as thronging to the spot and rendering the greatest service in extirpating the pests. The like has also been observed in Scandinavia during the wonderful irruptions of lemmings and other small rodents to which some districts are liable, and it would appear that the Short-eared Owl is the species which plays a principal part in getting rid of the destructive horde. An additional fact of some interest was noticed by Wolley, namely, that under such circumstances the owls seem to become more prolific than usual."

The following species of mammals and birds have been positively identified among the stomach contents:

MAMMALS.

Arvicola austerus.
Arvicola pinetorum.
Arvicola riparius.
Blarina brevicauda.
Sitomys americanus.
Mus musculus.
Sorex.
Reithrodontomys.
Lepus sylvaticus.
Sigmodon hispidus.

BIRDS.

Agelaius phœniceus.
Quiscalus quiscula æneus.
Poocœtes.
Spizella pusilla.
Junco hyemalis.
Melospiza georgiana.
Passerella iliaca.
Passer domesticus.
Merula migratoria.

The nest is a rough affair made of coarse grass and sticks, loosely drawn together and sparsely lined with fine material and feathers from the parent bird. It is placed on the ground, often in a depression made to receive it, under some bush or among high grass. In exceptional cases it has been found in a clump of low bushes, or otherwise slightly elevated. The eggs, which are from three to five in number, are deposited in April or May, according to the latitude of the nesting grounds.

The Short-eared Owl is pre-eminently a bird of the open country, including the coast marshes and islands covered by bushes and high grass. In the United States it is much more common in winter, receiving large reinforcements from the North. During this season of the year single individuals are usually met with, or less often small colonies, composed of four or five birds. Possibly these are families which have never been separated, having migrated in company from their nesting grounds. Large colonies, containing several hundred individuals, have been known to congregate in some desirable locality to spend the winter, and it is stated that they occasionally breed in considerable colonies.

DESCRIPTION.

Ear tufts inconspicuous, much shorter than middle toe with claws.

Color: Whole plumage varying from bright tawny to buffy white, with conspicuous dark brown stripes.

Length: 13.75 to 17 inches (350 to 432$^{\mathrm{mm}}$); extent, about 43 inches (1092$^{\mathrm{mm}}$); wing, 12 to 13 inches (305 to 330$^{\mathrm{mm}}$); tail, 5.75 to 6.10 inches (145 to 155$^{\mathrm{mm}}$).

Table showing the results of examinations of 101 stomachs of the Short-eared Owl (Asio accipitrinus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Washington, D. C	Nov. 22, 1886		2 juncos, 1 fox sparrow.		
Oakdale, N. Y	Nov. 27, 1886			Mouse	
Rockville, Conn	Oct. 22, 1886			2 meadow mice	
Do	do			Mouse hair	
Koshkonong, Wis	Sept. 25, 1886			Meadow mouse	
Washington, D. C	Apr. 20, 1887			3 meadow mice	
Hillsboro, New Brunswick.	Sept. 3, 1887			2 meadow mice	
Washington, D. C	Jan. —, 1887			1 meadow mouse	
Do	Mar. 28, 1887		Robin		
Hackensack, N. J	Mar. 31, 1887			2 meadow mice, 1 shrew.	
South Windsor, Conn	Mar. 29, 1887		Sparrow	2 meadow mice	
Do	do			do	
Do	Nov. 4, 1887			do	
Do	do			5 meadow mice	
Do	do			4 meadow mice	
Washington, D. C	Jan. 23, 1888			1 meadow mouse	
Glastonbury, Conn	Nov. 23, 1886				Empty.
Do	do				Do.
East Hartford, Conn	Nov. 11, 1886			4 meadow mice	
Do	Nov. 2. 1886			3 meadow mice	
Sandy Spring, Md	Jan. 28, 1887			Meadow mouse	
Do	Mar. 5, 1887			Mouse	
Do	do				Do.
Do	do				Do.
Do	do			Mouse	
Do	Jan. 7, 1888			2 meadow mice	
Do	Feb. 13, 1888				Do.
Chester County, Pa	Jan. 25, 1887			Meadow mouse	
Do	Dec. 21, 1886			do	
Do	Dec. 10, 1886			Pine mouse	
Do	Nov. 20. 1886			3 meadow mice	
Do	Nov. 25. 1886			1 meadow mouse	
Do	Nov. 27. 1886		Feathers		
Do	Dec. 8, 1886			Meadow mouse	
Do	Mar. 5. 1887				Do.
Do				Mice	
Do	Jan. 4, 1880			do	
Do	Jan. 5. 1880			do	
Dakota County, Nebr	July —, 1870			Rabbit	17 insects.
Lincoln, Nebr	Sept.—, 1868			Gopher	30 locusts.
Elmira, N. Y	Aug. 13, 1884			Field mice	Beetle.
Do	Aug. 2, 1886			do	Do.
Do	Aug. 7. 1886			do	Do.
Erin, N. Y	Oct. 5, 1887			do	Do.
Do	Dec. 29, 1887			do	Do.
Kings County, N. Y	Dec. 26, 1887			4 white-footed mice, 2 house mice, 1 shrew.	
Stratford, Conn	Nov. 3, 1888			Meadow mouse	
Sandy Spring, Md	Dec. 10, 1888			Mouse hair	

Table showing the results of examinations of 101 stomachs of the Short-eared Owl (Asio accipitrinus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
St. George, Utah	Jan. 8, 1889			White-footed mouse, harvest mouse.	
Washington, D. C	Mar. 13, 1889		Fox sparrow, and another sparrow.		
Lawrence, Queens County, N. Y.	Jan. 12, 1889			3 meadow mice	
Hancock County, Iowa	July 15, 1889			2 meadow mice, 2 shrews.	
Do	July 18, 1889			2 meadow mice	
Chester County, Pa	Nov. 28, 1882			Mice	
Jersey City, N. J	Oct. 14, 1888		Sparrow	Meadow mouse	
Story County, Iowa	Oct. —, 1883			Mouse hair	
Do	Jan. —, 1883			do	
Raleigh, N. C	Nov. 11, 1886			do	
Do	Nov. 8, 1887			Cotton rat	
Do	Nov. 12, 1887				Empty.
Do	Jan. 12, 1888			Meadow mice	
Cincinnati, Ohio	Nov. 9, 1884			Mice	
Do	Nov. 11, 1884		2 English sparrows.		
Franklin County, Ind	Dec. 3, 1886			2 mice	
Springfield, Ind	Dec. 6, 1886			Mouse hair	
Brookville, Ind	Jan. 10, 1887			2 mice	
Adams, Ind	do				Do.
Do	do			2 mice	
Fayette County, Ind	do			2 mice, 2 shrews.	
Union County, Ind	Jan. —, 1887			2 meadow mice	
Adams, Ind	Jan. 27, 1887			1 meadow mouse	
Springfield, Ind	Apr. 1, 1887			White footed mouse, meadow mouse.	
Rensselaer County, N. Y.	Jan. 18, 1888				Empty.
Albany County, N. Y.	Feb. 1, 1879			Meadow mice	
Do	Feb. 7, 1886			Mouse	
Do	do				Empty.
Do	Feb. 9, 1888				Empty.
Do	Mar. 30, 1888			Mouse	
Rensselaer County, N. Y.	Mar. 3, 1889			Meadow mice	
Stratford, Conn	Nov. 13, 1889		Swamp sparrow, other sparrow.		
Flatbush, N. Y.	Nov. 2, 1889				Empty.
Long Island City, N.Y.	Oct. 26, 1888		2 snowbirds, 1 grass finch, 1 field sparrow.		
Montauk Point, L. I., N. Y.	Dec. 12, 1889			Meadow mouse, white-footed mouse, shrew.	
Kennedy, Nebr	Apr. 15, 1890			Meadow mice, white-footed mice.	
Clay County, S. Dak	Sept. 12, 1889			White-footed mouse.	
Do	Oct. 27, 1889			White-footed mouse, meadow mouse.	
Keokuk, Iowa	Nov. 8, 1885		Grackle		
Do	Jan. 1, 1890			Mouse	
Portland, Conn	Oct. 8, 1890				Empty.
Union County, Ky	Nov. 5, 1889			3 meadow mice	
Sandy Spring, Md	Dec. 13, 1890				Empty.
Do	Dec. 20, 1890			2 meadow mice	
Do	do			do	
Montauk Point, L. I., N. Y.	Dec. 5, 1890			Meadow mouse	
Do	do			2 meadow mice	
Morristown, N. J	Jan. 24, 1891			Meadow mouse.	
Do	Feb. 10, 1891			3 meadow mice,	
Washington, D. C.	Nov. 20, 1891			3 meadow mice, 1 house mouse.	
Lancaster County, Pa.	Dec. 19, 1891			4 meadow mice	
Do	Dec. 21, 1891			3 meadow mice	
Do	Dec. 22, 1891		Red-wing blackbird.	Meadow mouse	

SUMMARY.—Of 101 stomachs examined, 11 contained small birds; 77, mice; 7, other mammals; 7, insects, and 14 were empty.

BARRED OWL.

Syrnium nebulosum.

[Plate 22—Adult.]

The Barred Owl inhabits eastern North America, ranging from Nova Scotia southward to the Gulf of Mexico, and westward to Manitoba, Dakota, Kansas, and Texas. Three geographical races inhabit, respectively, the southern United States from Florida to Texas (*Syrnium n. alleni*), eastern Mexico (*Syrnium n. sartorii*), and Central America (*Syrnium n. fulvescens*). The species is resident throughout its range except in the extreme northern part, from which it migrates more or less every fall and winter.

Relating to the food of this species, Audubon gives the following: "The Barred Owl is a great destroyer of poultry, particularly of chickens when half grown. It also secures mice, young hares, rabbits, and many species of small birds, but is especially fond of a kind of frog of a brown color very common in the woods of Louisiana. I have heard it asserted that this bird catches fish." (Ornith Biography, vol. I, p. 244.)

Nuttall gives the following information as to the food: "Their food is principally rabbits, squirrels, grouse, quails, rats, mice, and frogs. From necessity as well as choice they not unfrequently appear around the farmhouse and garden in quest of the poultry, particularly young chickens." (Land Birds, 1832, p. 134.)

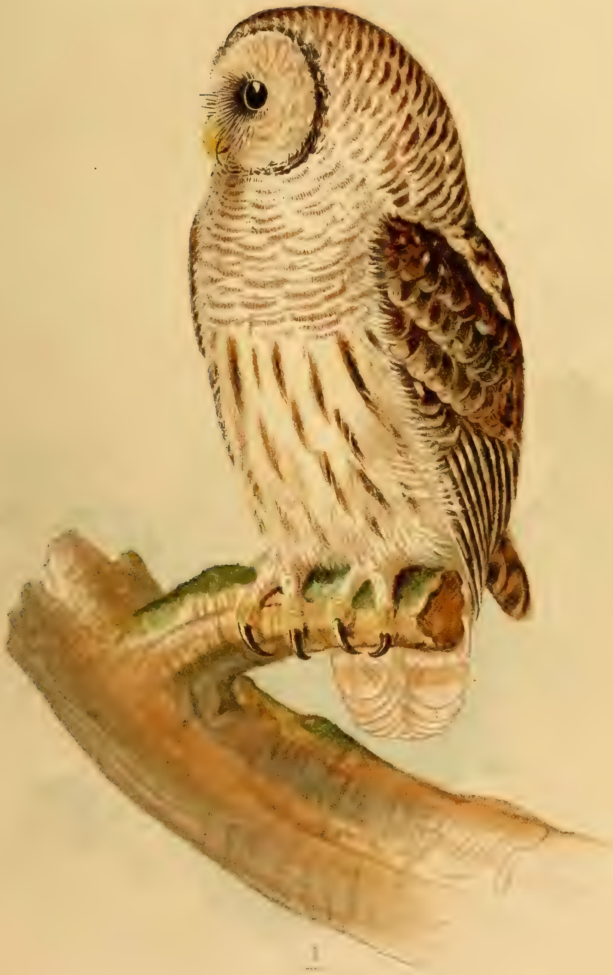
"Mr. Downes observed them to feed on hares, spruce and ruffed grouse, and other birds in Nova Scotia" (Hist. N. A. Birds, vol. III, p. 36).

Mr. H. Nehrling says: "In Texas where the hens, turkeys, etc., roost on trees, this owl is very destructive. They do not kill old poultry, but like half-grown chickens, and soon depopulate a whole poultry yard." (Bull. Nuttall Ornith. Club, vol. VII, p. 172.)

Dr. Wheaton, in his report on the birds of Ohio, 1882, gives a summary of its food as follows: "It sometimes visits chicken roosts and causes great devastation, but its ordinary food consists of squirrels, rats, mice, and small birds" (p. 412).

To all this testimony, which could be increased by the addition of many other notes attesting the destructiveness of the species to poultry and game, the investigations of the writer are in direct variance. Of the 109 stomachs examined four only contained the remains of poultry, and in one the trace of a game bird were found.

Dr. William C. Avery, of Greensboro, Ala., one of our valued correspondents, writes: "One evening about sunset while I was hunting, a Barred Owl pitched upon a wounded Bob-white which I had just shot." This incident recalls the interesting question of the part played by birds of prey in destroying sickly or wounded game. The following from Prof. Baird to Mr. J. W. Shorton, which was published in the



BARRED OWL

Journal of the Cincinnati Society of Natural History (vol. V, 1882, pp. 69–70), seems to answer the question conclusively:

> *Washington, April 10, 1882.*
>
> DEAR SIR: The destruction of hawks will save an occasional fowl, but will cause a great increase in the abundance of field-mice, rabbits, squirrels, snakes, frogs, etc., upon which the hawks feed.
>
> It has now been conclusively shown, I think, that hawks perform an important function in maintaining in good condition the stock of game birds, by capturing the weak and sickly, and thus preventing reproduction from unhealthy parents. One of the most plausible hypotheses explanatory of the occasional outbreaks of disease among the grouse of Scotland has been the extermination of these correctives, the disease being most virulent where the game-keepers were most active in destroying what they considered vermin. It is my firm conviction that in the average of well-settled countries the hawks and owls are a benefit rather than the reverse to the community in general, and to the farmer in particular.
>
> Yours respectfully,
>
> SPENCER F. BAIRD.

This Owl seems to be more given to cannibalistic habits than any of the other species. In seven stomachs the writer found the remains of smaller Owls among the contents, and Mr. Austin F. Park mentions finding the remains of a Screech Owl in the stomach of a Barred Owl killed in a thickly built part of Troy, N. Y. (Bull. Nuttall Ornith. Club, vol. V, p. 185.) Mr. Charles Dury, in "Notes on the Food of Raptorial Birds," says that he found a Screech Owl in the stomach of an individual shot near Cincinnati. (Journ. Cincinnati Soc. Nat. Hist., vol. VIII, 1885, pp. 62–66.) Now and then small birds are killed by this species, but mammals furnish a large proportion of its food. The remains of mice, rabbits, squirrels (red, gray, and flying), shrews, moles, and occasionally weasels, have been found among the stomach contents. The species, owing to its large size, is capable of consuming large numbers of mice at one meal. Dr. C. Hart Merriam took the remains of at least a dozen red-backed mice (*Evotomys*) from a single specimen killed near Moose River, in northern New York.

Frogs and other batrachians are not uncommonly taken, and crawfish are evidently a somewhat favorite food, as shown by the frequency of their occurence among the stomach contents. Fish are sometimes eaten. Mr. Edward Swift, of Elmira, N. Y., has found their remains in the stomach contents, and Dr. Warren relates that he was informed by two gentlemen in Florida that it frequently preys on fish, which it secures, by a dexterous movement of the foot, while sitting close to the water's edge (Birds of Pennsylvania, 1888, p. 111). At certain times of the year insects are considerably sought after by this bird, grasshoppers, crickets, and the larger beetles being the kinds most often taken.

In summing up the facts relating to the food habits of this Owl it appears that, while the general statements of certain authors, especially the earlier ones, charge the bird with the destruction of poultry, game, and small birds, such destructive habits are comparatively uncommon. That it does occasionally make inroads upon the poultry yard and does more or less damage among game birds, is true; but the systematic collection and examination of a large number of stomachs show the exceptional character of such acts and reveal the fact that the larger part of its food consists of mammals. And it is to be noted that among the list are some of the most destructive rodents the farmer has to contend with. If a fair balance be struck, therefore, it must be considered that this Owl is on the whole beneficial, and hence should occupy a place on the list of birds to be protected.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Arvicola riparius.
Arvicola pinetorum.
Blarina brevicauda.
Tamias striatus.
Sciurus hudsonicus.
Sciuropterus volucella.
Lepus sylvaticus.
Sitomys aureolus.
Sitomys americanus.
Evotomys gapperi.
Scalops aquaticus.
Synaptomys cooperi.
Mus decumanus.

BIRDS.

Bonasa umbellus.
Megascops asio.
Nyctala acadica.
Melanerpes carolinus.
Passerella iliaca.

In the South the eggs are deposited late in February or the first week in March, while in the North their deposition is a month or six weeks later.

The following extract from an article by 'J. M. W.' (Calvin Rawson), of Norwich, shows that it sometimes breeds in February as far north as Connecticut: "During the open Februarys, several years ago, Mr. Brand and myself took eggs in winter; but of late the last of March sees full clutches of this bird. I have seen eggs on a solid cake of ice, in a hole, and in open nests, with a foot of snow in the woods." (Ornithologist and Oologist, vol. XIII, 1888, p. 37.)

The ovaries in some of the birds captured in southern New York about the first of April were still in an undeveloped state, while other birds had deposited eggs. It thus appears that in the same locality the pairs do not all breed at the same time.

The nest, like that of the Great Horned Owl, is situated indiscriminately in hollows or among the branches of trees. In the North a nest among the branches is more common and, although the structure may occasionally be made by the bird, the remodeled nest of the crow or hawk is more often used. It is not to be understood that the use of cavities in the North is at all uncommon, for probably a third of the nests are so situated, while in the South an open nest is rare. This species shows great fondness for a favorite nesting site, which it will occupy year after year even though it be habitually robbed of its eggs. The eggs are usually two or three in number, although sets of four and five have been taken.

This Owl is a lover of deep, dark woods, where it spends most of the day in quiet among the thick foliage. Heavy wooded swamps, with their luxuriant growth and festoons of vines, or the stately hemlock forests are the places preëminently suited to the bird's taste.

It is the commonest species of rapacious bird throughout the extensive swamps covered by cypress and other growths which abound in the coast region of the South, where as many as fifteen or twenty may be seen in a day's tramp. Although not usually seen near habitations, it sometimes wanders into large towns, either in search of food or the shelter afforded by some attractive clump of evergreens.

Mr. F. H. Carpenter makes the interesting statement that in the vicinity of Kingfield, Me., this Owl often resorts to barns during the day time and is known locally as "Barn Owl." (Ornithologist and Oologist, vol. XI, 1886, p. 177.)

When kept in captivity it soon becomes tame, especially when taken young, and makes a gentle and interesting pet, soon learning to know its master and to greet his coming with signs of affection and pleasure.

This Owl, like others of the family, generally remains quiet during the brightest part of the day. This habit is from choice and is not due to any defect in its vision. The familiar instances cited in books, where is has been known to alight on a collector's gun barrel or the back of a cow, are not evidences of defective vision, but merely show that the bird was preoccupied or had its eyes fastened on some object of unusual interest. A hawk has been known to follow a chicken into the house and attack it under a chair occupied by a person; yet no one will argue that the hawk was unable to see the individual. Mr. Frank Bolles found that his pet Barred Owls could not see in an ordinary degree of darkness, and thinks they sleep at night. (Auk, vol. VII, 1890, p. 106.)

Although usually quiet, it evidently does some hunting during the day, especially during the breeding season. Once on a bright afternoon in May, near Lake Pontchartrain, Louisiana, the writer saw one of these Owls flying over a protection levee to a swamp on the opposite side. It carried in its talons a bird, presumably a grackle, judging from the number of these birds which followed in hot pursuit and attacked it evidently in the hope of liberating their unfortunate comrade. This black and irritated mass followed the Owl into the swamp beyond, from which their scoldings could be heard for some time.

The hearing of the Barred Owl, like all other species, is very acute. On one occasion the writer was standing near a large tree in a dense swamp in the vicinity of Mobile, attempting to attract a small bird by the aid of a low squeaking noise. Through the foliage, some 50 yards or more distant, a pair of large birds were seen winging their way, and as the noise was continued they alighted within a few feet of its source, but on the opposite side of the tree. Great was their surprise to see a head cautiously appear from behind the trunk, and after a few bewildered glances they beat a precipitate retreat, doubtless very much chagrined at the deception.

This is one of the most noisy of the Owls, and probably is oftener heard than any other. This is particularly true in the mating season, at which time, in localities where it is abundant, the woods resound with its weird but not unpleasant notes from early dusk to morn, and even at intervals during the day. At no time of the year is it altogether quiet, though during the period the young are being cared for it is seldom heard. Years ago in the months of October and November, while camping in the Adirondack wilderness in northern New York, one or more of these birds were heard nearly every evening, and a few times during the day. On one occasion, by imitating their notes, Dr. C. Hart Merriam brought two or three in close proximity to the camp, but we were unable to secure specimens on account of the darkness.

The flight is light, easy, rapid, and, as with other Owls, noiseless.

DESCRIPTION.

Large size. No ear tufts. General color deep umber-brown and buffy whitish. The plumage everywhere barred transversely except on the belly, where the stripes run lengthwise; bill yellow; eyes brown-black.

Length: 19 to 24 inches (482 to 610$^{\text{mm}}$); extent about 46 inches (1168$^{\text{mm}}$); wing 12.50 to 14 inches (317 to 355$^{\text{mm}}$); tail 9 to 10 inches (228 to 254$^{\text{mm}}$).

Table showing the results of examinations of 109 stomachs of the Barred Owl (Syrnium nebulosum).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Englewood, N. J	Feb. 22, 1886			Meadow mouse	
Alfred Center, N. Y	Oct. 22, 1886			Red squirrel	
Whitewater, Wis	Aug. 30, 1886				Empty.
Washington, D. C	Feb. 15 1887				Do.
Do	Mar. 16, 1887			Shrew	Frog, 8 larvæ.
Greensboro, Ala	Nov. 15, 1887				Spider, grasshoppers, crickets.
Moose River, N. Y	June 10. 1878			12 red-backed mice.	
Sing Sing, N. Y	Nov. 27, 1882	Fowl			
Do	Jan. 21, 1885			2 meadow mice	
Do	Mar. 21, 1885		Saw-whet owl		
St. Louis, Mo	Spring, 1885		Screech owl		
Eubank, Ky	Mar. 21, 1887			Meadow mice, rabbit.	
Greensboro, Ala	Nov. 12, 1887				Empty.
Sandy Spring, Md	Apr. 25, 1887				Crawfish.
Do	Nov. 14, 1887			4 meadow mice	
Do	Nov. 28, 1887		Screech owl		
Do	Feb. 11, 1888				Empty.
Do	Feb. 18, 1888			Meadow mouse	
Do	Feb. 19, 1888			Rabbit	
Chester County, Pa	Dec. 10, 1886			Flying squirrel	
Do	Dec. 16, 1886			Rabbit	

Table showing the results of examinations of 109 stomachs of the Barred Owl (Syrnium nebulosum)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chester County, Pa				Mice	
Do	Jan. —, 1889			do	
	Jan. 17, 1881			do	
Elmira, N. Y	Aug. 1, 1885				Frog, crawfish.
Do	Aug. 7, 1886			Several mice	
Waverly, N. Y	Sept. 4, 1887			Mice	Insects.
Barton, N. Y	Oct. 17, 1886			Field mice	
Halsey Valley, N. Y	Oct. 5, 1887				Fish, insects.
Elmira, N. Y	Nov. 4, 1884			Mice	
Tyrone, N. Y	Nov. 13, 1887				Empty.
Elmira, N. Y	Dec. 1, 1886			Weasel	
Caton, N. Y	Jan. 1, 1885			Mice	
Tioga, N. Y	Feb. 9, 1886			Field mouse, mole.	
Elmira, N. Y	Feb. 19, 1887		Small birds		
Do	Mar. 3, 1886			Field mice	
Alexandria, Va	Apr. 17, 1888				Do.
Gainsville, Fla	Apr. 20, 1887				Frog, crawfish, Grasshoppers, larvæ, beetle.
Do	May 9, 1887				Lizard.
Do	Dec. 29, 1887			Mouse	
Do	Feb. 19, 1888			do	
Newtown, Conn	Oct. 23, 1880		Sparrow		
Englewood, N. J	Feb. 26, 1886			2 mice	
St. Helena Island, S. C	Apr. 15, 1885			Rabbit	
Maplewood, N. J	———, 1882				3 fish, 1 frog.
Do					Crawfish.
Story County, Iowa	Nov. 8, 1883				Do.
Raleigh, N. C	Feb. 7, 1887				Do.
Do	Feb. 15, 1887				Empty.
Do	Apr. 21, 1887				Do.
Do	Sept. 1, 1887				Beetles.
Do	Apr. 9, 1888				Empty.
Saratoga County, N. Y	Dec. 19, 1886			Mice	
Washington County, N. Y.	Nov. 13, 1880				Crawfish, grasshoppers.
Troy, N. Y	Apr. 14, 1879		Screech owl		
Rensselaer County, N. Y.	Feb. 9, 1883				Empty.
Do	Nov. 28, 1884			Mouse	
Do	Aug. 21, 1886			Mice	
Do	Oct. 19, 1886				Do.
Do	Oct. 30, 1886			Squirrel, mice	
Do	Nov. 30, 1886				Do.
Do	Mar. 10, 1887			3 meadow mice	
Do	Mar. 22, 1887				Do.
Do	Oc. 16, 1888			Red squirrel	
Do	Dec. 15, 1888			Squirrel, mice	
Sandy Spring, Md	May 19, 1888				Do.
East Hartford, Conn	Oct. 31, 1887				Do.
Do	Apr. 20, 1888			Meadow mouse	
Sandy Spring, Md	June 3, 1888			Pine mouse	
Woodville, Minn	Apr. 6, 1888		Fox sparrow	Meadow mouse, red-backed mouse.	
Do	Apr. 16, 1888			3 meadow mice	
Virginia	Oct. 21, 1888				Crawfish.
Washington, D. C	Nov. 30, 1888			2 meadow mice	2 crawfish.
Sandy Spring, Md	Dec. 9, 1888				Grasshopper remains.
Gettysburg, Pa	Jan. 7, 1889	Pigeon.			
Sandy Spring, Md	Jan. 12, 1889			Meadow mouse	
Do	do			Meadow mouse, mole.	
Washington, D. C	Jan. 22, 1889	Fowl			
Hale County, Ala	Oct. 18, 1889				3 white grubs, cricket, 4 spiders.
Alfred Center, N. Y	Oct. 11, 1889			Cooper's mouse	
Cincinnati, Ohio	Nov. 11, 1884		Screech owl		
Do	Nov. 30, 1884			Mice	
Do	Jan. 16, 1885			do	
Do	do		Red-bellied woodpecker.		
Adams, Ind	Jan. 18, 1887			Meadow mouse	
Brookville, Ind	Dec. 15, 1887			White-footed mouse.	
Kalamazoo, Mich	Oct. 1, 1886		Sparrow		

Table showing the results of examinations of 109 stomachs of the Barred Owl (Syrnium nebulosum)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Kalamazoo, Mich	Oct. 17, 1886			Red squirrel	
———, Fla	Summer, 1880		Small birds	Mice	
Stratford, Conn	Dec. 18, 1888		Screech owl	Mole	
Toronto, Ontario	Jan. 24, 1890			Rat	
Do	Jan. 29, 1890			2 meadow mice	
Sandy Spring, Md	April 23, 1890				Snail, beetle.
Orange County, N. Y	Oct. 23, 1876				Empty.
Bay St. Louis, Miss	Aug. 30, 1890				Beetle remains.
Sandy Spring, Md	Nov. 6, 1890			2 meadow mice	Beetle.
Portland, Conn	Oct. 16, 1890			2 meadow mice, 1 white-footed mouse.	
Do	Oct. 18, 1890				Larva.
Do	Oct. 25, 1890			3 meadow mice, 1 rat.	
Do	Nov. 1, 1890				Empty.
Sandy Spring, Md	Nov. 30, 1890		Screech owl	Meadow mouse	
Do	do			2 meadow mice	
Morristown, N. J	Oct. 4, 1890			Short-tailed shrew.	
Do	Nov. 4, 1890	Fowl		do	
Do	Nov. 17, 1890	Ruffed grouse.			
Columbus, Ohio	Oct. 1, 1890			Chipmunk	2 snails, 1 beetle.
Easton, Md	Feb. 22, 1891			Meadow mouse	
Lancaster County, Pa	Nov. 30, 1890				Empty.
Meriden; Conn	Mch. 20, 1891				Do.
Washington, D. C	April 5, 1892				Do.

SUMMARY.—Of 109 stomachs examined, 5 contained poultry or game; 13, other birds; 46, mice; 18, other mammals; 4, frogs; 1, a lizard; 2, fish; 14, insects; 2, spiders; 9, crawfish, and 20 were empty.

SPOTTED OWL.

Syrnium occidentale.

The Spotted Owl, which may be considered a western representative of the Barred Owl, inhabits the highlands of Mexico, New Mexico, Arizona, Colorado, California, and Lower California. It was discovered by Xantus near Fort Tejon, Cal., March 6, 1858, and described by him in 1859 in the proceedings of the Academy of Natural Sciences, Philadelphia. Not until 1872 was the bird again met with, when Capt. Bendire found it in the southern part of Arizona, where on April 17, 1872, he found a nest and one egg, 9 miles west of Tucson. "The nest appears to have been built by the birds themselves. It was composed of small sticks and twigs and lined with dry grasses, pieces of bark, and a few feathers, placed close to the trunk of a large cottonwood tree, about 30 feet from the ground and easily seen from below. One of the parents was sitting on the nest and shot with a rifle after flying off, but not preserved. * * * The specimen sent to Mr. Ridgway was shot some time subsequently to my finding this nest, as I noticed on a critical examination of this bird that it differed from the Barred Owl in its markings." (Ornithologist and Oologist, vol. VII, 1882, p. 99.)

Mr. L. Belding secured a pair at Big Trees, Calaveras County, Cal., in the summer of 1880. He says: "Its call resembles the barking of a dog, the first three or four notes lasting about one second each; these succeeded by long, harsh, whining notes."*

Mr. H. W. Henshaw took a specimen in the Upper Pecos region, N. Mex., August 20, 1883, but did not ascertain whether it bred or was common there. (Auk, vol. III, 1886, p. 79.)

Mr. A. W. Anthony secured a specimen in Colorado in January or February, 1882. "It was in a wet, marshy place grown up to coarse grass. The bird seemed to make its home in this locality for some time, as he says he flushed it from the grass on several different occasions during the winter before he succeeded in shooting it" (Auk, vol. III, 1886, p. 284).

As yet very little is known of the habits of this species and absolutely nothing of the food. It is to be presumed, however, that the latter is of much the same character as that of the Barred Owl.

DESCRIPTION.

Size, color, and form, much the same as the Barred Owl, but the barring on the head and back is broken up into round or irregular spotting. The belly is transversely barred much the same as the breast instead of being streaked as in the Barred Owl.

Length: 19 inches (482^{mm}); wing, 12 to 13.50 inches (305 to 342^{mm}); tail, about 9 inches (228^{mm}).

GREAT GRAY OWL.

Scotiaptex cinerea.

This large and handsome Owl is a boreal species, occurring in arctic and northern temperate America and migrating south in winter to the northern United States. A closely related geographical race (*Scotiaptex c. lapponicum*) inhabits the northern portions of Europe and Asia, straggling eastward to western Alaska. The Great Gray Owl is a very rare winter or accidental visitant as far south as the fortieth parallel, the limit of its wandering being reached in southern New England, New York, New Jersey, Ohio, and Illinois in the East, and northern California in the West. It is a common resident throughout all the wooded portions of Alaska, as it is in the Anderson River region and the fur countries generally.

The food seems to consist principally of hares, mice, and other of the smaller mammals as well as small birds. Whether it destroys many grouse or ptarmigans is not stated by authors who are most familiar with the bird. Dr. W. H. Dall took no less than thirteen skulls and other remains of red-poll linnets (*Acanthis*) from the crop of a single bird.

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*Mr. F. Stephens secured an adult and young of this species at Smith Mountain, some 50 miles NNE. of San Diego Bay, California, June, 1892. (Auk., vol. IX, 1892, pp. 392-393.)

The following species of mammals were positively identified among the stomach contents: *Scapanus americanus*, *Arvicola riparius*, *Blarina brevicauda*, and *Sitomys americanus*.

Richardson found a nest on May 23 which contained three young. It was situated in a lofty balsam poplar and was composed of sticks, with a lining of feathers. The nest found by Mr. McFarlane on July 19, on the Anderson River, was placed in the top of a pine [spruce] about 20 feet from the ground and contained two eggs and two young. Probably the number of eggs in a set varies from three to five, and their deposition usually takes place some time in April.

Dr. Dall considers it a stupid bird and states that sometimes it may be caught in the hands. Its great predilection for thick woods, in which it dwells doubtless to the very limit of trees, prevents it from being an inhabitant of the barren grounds or other open country in the North. It is crepuscular or slightly nocturnal in the southern parts of its range, but in the high North it pursues its prey in the daytime. In the latter region, where the sun never passes below the horizon in summer, it is undoubtedly necessity and not choice that prompts it to be abroad in the daylight.

It is stated that the flight is heavy and somewhat labored, and has not the bouyancy noted in that of most of the Owls. This statement may result from the point of view of the observer, for it does not seem likely that its flight differs materially from that of the Barred Owl.

The note of this Owl is said to be a tremulous, vibrating sound, somewhat resembling that of the Screech Owl.

DESCRIPTION.

Largest of our Owls. No ear tufts. Wing, 16 to 18 inches (406 to 456^{mm}); bill, small, nearly hidden by feathers; eyes, yellow; general color, dusky grayish brown and grayish white.

Length: 25 to 30 inches (635 to 762^{mm}); extent, 54 to 60 inches (1370 to 1524^{mm}); wing, 16 to 18 inches (406 to 456^{mm}); tail, 11 to 12.5 inches (280 to 317^{mm}).

Table showing the results of examinations of 9 stomachs of the Great Gray Owl (Scotiaptex cinerea).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Carberry, Manitoba	Sept. 29, 1889			1 shrew	
Lake Nipissing, Canada.	Oct. 29, 1889			4 meadow mice, 1 shrew.	
Haliburton, Ont	Dec. 20, 1889		Snowbunting.	Short-tailed shrew.	
Muskoka, Ont	Dec. 27, 1889			3 meadow mice	
Beavertown, Ont.	Jan. 29, 1890			1 white-footed mouse, 4 meadow mice.	
Mt. Albert, Ont.	Feb. 18, 1890			5 meadow mice	
Dover, Maine	Mar. 8, 1890			Brewer's mole, meadow mouse.	
Elk River, Minn.	Fall, 1889			3 meadow mice	
Do	Jan. 5, 1890			5 meadow mice	

SUMMARY.—Of 9 stomachs examined, 1 contained a small bird; 7, mice; and 4, other mammals.

RICHARDSON'S OWL.

Nyctala tengmalmi richardsoni.

Richardson's Owl is a boreal species inhabiting North America from the limit of trees south to the northern tier of States. It is merely a geographical race of Tengmalm's Owl, which inhabits the pine belt of the northern portion of the Eastern Hemisphere. Although the latter bird is said to breed in the Alps and Carpathians, it is accidental in the British Isles and is a rare winter visitant to Holland, Germany, and central Russia. It is extremely doubtful whether the American bird is ever other than a winter visitor within the limits of the United States. One or two specimens have been taken in winter as far south as Connecticut and Rhode Island, and on the west coast it is very rare as far south as Oregon. From this it will be seen that it differs materially from the more arctic Snowy Owl, which occasionally extends south in winter as far as the central United States.

The food, according to the published accounts, which are mostly general, consists of mice, insects, and small birds. In the vicinity of Fort Simpson, Mr. Ross stated that it produced sad havoc among the flocks of linnets. Mr. H. W. Wheelwright in Scandinavia one night shot a female in full chase of a lemming on a frozen lake. Undoubtedly, like the other small Owls, it feeds largely on small rodents and insects, and when these are scarce depends on small birds for sustenance.

It is common throughout northern Alaska wherever trees or large bushes occur to afford it shelter. It breeds in hollows of trees as well as in the deserted nests of other birds. It is very partial to the old holes of the pileated woodpecker (*Ceophlœus*), which seem to be just the size and shape to suit its fancy.

At the mouth of the Yukon, where there are no trees, Mr. E. W. Nelson says the eggs are deposited in old nests found in bushes. The eggs, which are from three to five in number, are deposited from the first of May to early in June, according to the latitude of the nesting ground.

Richardson's Owl is nocturnal in its habits, remaining quiet during the day in the thick foliage of the trees or bushes. In fact, its vision is apparently so affected by bright light that many specimens have been captured alive by persons walking up and taking them in their hands. On this account the Eskimo in Alaska have given it the name of 'blind one.'

The song of this Owl, according to Dr. Merriam (Bull. Nuttall Ornith. Club, vol. VII, 1882, p. 237), is a low, liquid note that resembles the sound produced by water slowly dropping from a height.

DESCRIPTION.

No ear-tufts; wings 6.50 inches (165^{mm}) or more; tail more than 4 inches (102^{mm}); legs and feet usually buffy, more or less spotted with brown; feathers covering under base of tail, striped with brown.

Length: 9 to 12 inches (228 to 305^{mm}); wing 6.60 to 7.40 inches (167 to 187^{mm}); tail 4.10 to 4.70 inches (103 to 119^{mm}).

SAW-WHET OWL.

Nyctala acadica.

The little Saw-whet, or Acadian Owl, inhabits temperate Canada and the northern United States, ranging south to about the thirty-ninth parallel in the east, and in the mountains to southern Mexico in the west. It breeds sparingly in Massachusetts and New York, and probably in suitable localities all across the continent to Oregon, north of the forty-second parallel of latitude. Occasionally it wanders south in winter as far as the Carolinas and Kentucky.

The food of this little Owl is composed almost entirely of mice, of which the wood-dwelling species seem to predominate. At times it attacks larger mammals, such as rats, half-grown red squirrels and chipmunks. The following, from Mr. George Lawrence Nicholas, is most extraordinary, as it hardly seems possible that so small a bird could swallow so large a morsel: "To-day, while hunting in a pine wood near this town [Summit, N. J.], I obtained an Acadian owl. Upon dissecting it I found that its stomach contained a flying squirrel, which had been swallowed whole and but slightly digested." (Forest and Stream, vol. XII, February 27, 1879, p. 67.)

It rarely molests small birds, unless its favorite food—mice—for some reason, is scarce. Occasionally it feeds on scraps of raw or cooked meat, which it has been observed to pick up in the vicinity of camps, and in winter, in the north, it will feed on the carcasses of comparatively large animals. Dr. Merriam mentions the following, which occurred at Point de Monts, Canada: "In winter Mr. Comeau once saw one of these little owls fly from within the carcass of a great northern hare that had been caught in a snare. The owl had eaten away the abdomen and was at work within the thoracic cavity when frightened away." (Bull. Nuttall Ornith. Club, vol. VII, 1882, p. 237.)

It also feeds to some extent on insects of various kinds. Thus it will be seen that while the diminutive size of the Saw-whet limits its power of usefulness, its mode of life renders it a useful adjunct to the farmer, and, small though it be, yet in districts where it abounds the number of mice it annually destroys must be very large.

Mr. Brewster gives an interesting account of the operation of disgorging the pellets which he observed in a young specimen in his possession: "The owl would gape several times, then the head would be violently shaken sideways, and finally the pellet, coated with mucous, would shoot forth, frequently falling several inches in front of the spot where the bird was sitting. After it was all over the little fellow assumed an expression of relief and contentment which was very comical." (Bull. Nuttall Ornith. Club, vol. VII, 1882, p. 24.)

The following species of mammals were positively identified among the stomach contents: *Arvicola riparius*, *Sitomys americanus*, *Sitomys a. sonoriensis*, *Sorex*, and *Mus musculus*.

The eggs are generally deposited in the hollows of trees, the deserted burrows of woodpeckers being the favorite place, though open nests are sometimes used for the purpose. Mr. W. Perham, of Tyngsboro, Mass., was very successful in inducing this Owl to build in nests which he put up in different parts of the forest. These 'nests' were sections of hollow limbs closed at the ends, with an entrance hole made in the side. As a rule this species uses no other nesting material than the rotten chips found in the cavities, or such accidental material as has been dragged in by squirrels or mice.

The number of eggs is from four to seven, and it would seem from Mr. Egbert Bagg's experience in central New York, that the larger number is more common. They are usually deposited by the first week in April, at which time full sets are found. A set of eggs taken by Mr. Egbert Bagg on April 7, 1886, in Oneida County, N. Y., were in different stages of incubation, proving that the female had remained on the eggs from the time the first egg was deposited. Unlike the little Screech Owl, this species is very apt to leave the nesting cavity when the tree is shaken or jarred during the ascent to it.

The species is not migratory, but is more or less of an irregular wanderer in its search for food during the fall and winter. It may be quite common in a locality and then not be seen again for several years. It is nocturnal, seldom moving about in the daytime, but passing the time in sleeping in some dark retreat. So soundly does it sleep that often times it may be captured alive, as in the following case cited by Mr. Ridgway: "But a single individual of this pretty little Owl was met with; this one was captured alive by Mr. O. L. Palmer, of our party, who found it asleep and placed his hat over it. It was perched on the edge of an old Robin's nest, in a dense willow thicket near camp." (U. S. Geol. Explor. of the Fortieth Parallel, King, vol. IV, 1877, p. 572.)

During the day it frequents the thick evergreen woods, though sometimes it is found in comparatively open groves, but always in dense trees. Mr. W. E. D. Scott found it common in scattered cedar groves at Princeton, N. J., in December 1878, when he obtained seventeen specimens in two days; while in January, which was colder, he met with more in hollow trees. (Bull. Nuttall Ornith. Club, vol. IV., 1879, p. 85.) In the Dead River region, Maine, on January 7, Mr. F. H. Carpenter found three sitting close together on a joist on a grain shed of a lumber camp. (Ornithologist and Oologist, vol. XI, 1886, p. 177).

The mortality which sometimes occurs among this species in winter is difficult to account for. Specimens which show no signs of violence, though somewhat emaciated, are found on barn floors, under trees, or along fences. That cold has anything to do with killing this hardy little Owl is not to be supposed, for such accidents occur more often towards the southern limit of its range; and why should it starve in localities where food abounds, as about Washington, where most of the specimens secured have been picked up dead?

This little Owl is mild and gentle in disposition while in captivity and makes an interesting pet. It will soon allow itself to be handled, and is particularly fond of having its head gently scratched.

Although seldom known to hunt during the daytime, there are exceptions, as in the case occurring near Washington, D. C., where Mr. J. D. Figgins killed a specimen which was feeding on a junco and surrounded by a mob of small birds. (Auk, vol. VI, 1889, p. 189.)

The note of this species is peculiar and has a rasping character, resembling the sound made when a large-toothed saw is being filed; hence the name. It is more often heard during March and early April, though occasionally it is heard at other times of the year.

The flight resembles that of the woodcock very closely, so much so in fact, that the writer once killed a specimen as it was flying over the alders, and not until the dog pointed the dead bird was he aware of his mistake.

DESCRIPTION.

Smallest Owl of the eastern United States; no ear tufts; wing less than 6 inches (152^{mm}); tail less than 3.50 inches (88^{mm}); above, brown, more or less spotted with white; beneath white, striped with reddish brown.

Length: 7.25 to 8.50 inches (183 to 215^{mm}); wing, 5.25 to 5.90 inches (133 to 149^{mm}); tail, 2.80 to 3.25 inches (70 to 82^{mm}).

Table showing the results of examinations of 22 stomachs of the Saw-whet Owl (Nyctala acadica).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Taunton, Mass	Dec. 11, 1885			Mouse hair	
East Hartford, Conn	Jan. 7, 1887			White-footed mouse.	
Hillsboro, N. B.	Oct. 21, 1886			Mouse hair	
Flatbush, N. Y.	Nov. 3, 1887			House mouse	
Locust Grove, N. Y.	Jan. 24, 1884			Meadow mouse	
Sing Sing, N. Y.	Jan. 13, 1885			do	
District of Columbia	Mar. 12, 1889		Sparrow		
Do	Nov. 1, 1889				Empty.
Do	do				Do.
Story County, Iowa	Dec. —, 1882			Mouse	
Do	Dec. —, 1882			do	
Do	Jan. 8, 1883			do	
Do	Oct. —, 1883			do	
Rensselaer County, N. Y.	Jan. 31, 1887			Mice	
San Francisco Mountain, Arizona.	June 12, 1887			Meadow mice, white-footed mice.	
Do	do			do	
Do	do			do	
Do	do			do	
New Haven, Conn.	Nov. 14, 1890				Moth.
Brookland, D. C	Dec. 12, 1890			Meadow mouse	
Horse Hill, N. J.	Oct. 29, 1890			Small shrew, white-footed mouse.	
Wilmington, Mass	Feb. 19, 1892				Empty.

SUMMARY.—Of 22 stomachs examined, 17 contained mice; 1, a bird; 1, an insect; and 3 were empty.

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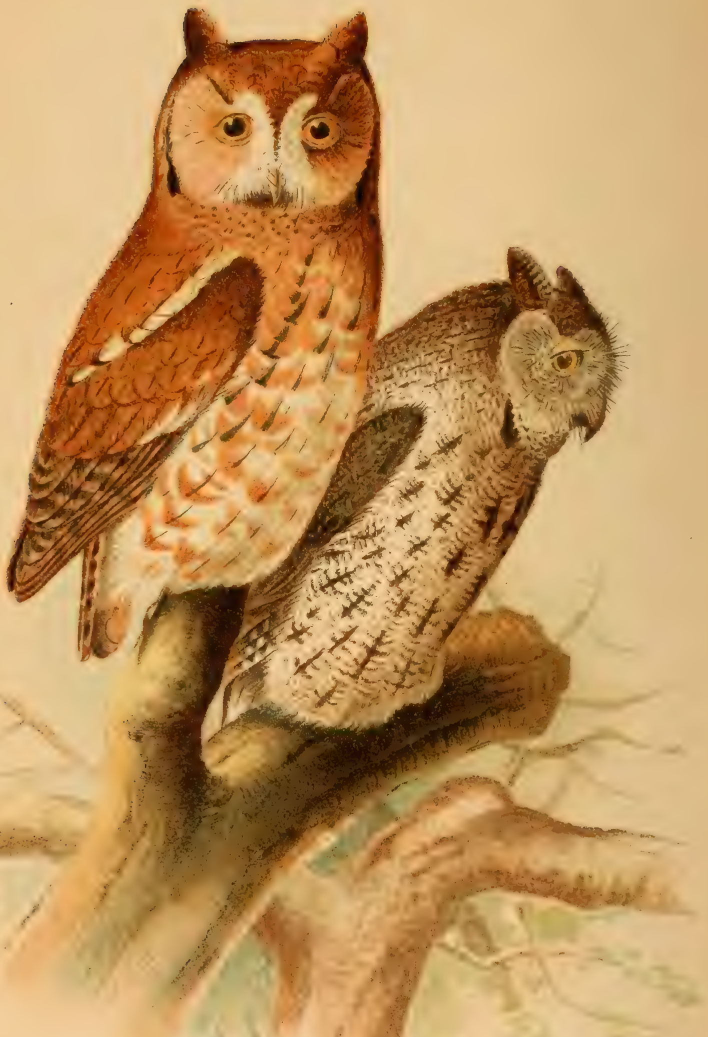

SCREECH OWL

SCREECH OWL.

Megascops asio.

[Plate 23—Red and gray phases.]

The little Screech Owls are distributed over the temperate parts of the globe and are among the better known of the Owls.

The Common Screech Owl is distributed throughout the whole of the United States and the southern portions of the British provinces. It is separable into several geographic races, as is usual in species having such an extensive distribution. The typical form (*Megascops asio*) ranges from the eastern United States and the British provinces south to about the thirty-second parallel and west to the Great Plains. The Florida Screech Owl (*Megascops asio floridanus*) inhabits the Gulf States from Louisiana to Florida and extends north along the coast to South Carolina. The Texas Screech Owl (*Megascops asio mccallii*) is found in southern Texas and eastern Mexico southward to Guatemala. The Mexican Screech Owl (*Megascops asio trichopsis*) inhabits northwestern Mexico, Lower California, Arizona, and New Mexico. The California Screech Owl (*Megascops asio bendirei*) is limited to California. Kennicott's Screech Owl (*Megascops asio kennicottii*) inhabits the Northwest coast, from Oregon to Sitka, and east to northern Montana.* The Rocky Mountain Screech Owl (*Megascops asio maxwelliæ*) is found in the Rocky Mountains, from Colorado to eastern Montana.

Their food consists of a great variety of animal life, including mammals, birds, reptiles, batrachians, fish, crustaceans, and insects. At night-fall they begin their rounds, inspecting the vicinity of farm-houses, barns, and corncribs, making trips through the orchard and nurseries, gliding silently across the meadows or encircling the stacks of grain in search of mice and insects. Thousands upon thousands of mice of different kinds thus fall victims to their industry. Their economic relations therefore are of the greatest importance, particularly on account of the abundance of the species in many of the farming districts, and whoever destroys them through ignorance or prejudice should be severely condemned.

Those who have rambled much in the country in the clear winter mornings must have noticed the tracks of mice which often form networks in the snow, crossing and recrossing, passing in and out of walls and stacks, or converging toward some choice bit of food—all tend-ing to show how active these little rodents are during the night, a period when most of the world sleeps. Occasionally a track stops abruptly, and while the observer is trying to read more of the history written in the snow, his eyes catch the faint impression of a pair of wing tips near where the trail ends, and instantly he recognizes that a tragedy has been enacted. Beside the different species of mice, the Screech Owl feeds on other small mammals, such as chipmunks, shrews, moles, and occasionally bats. During warm spells in winter it forages quite extensively and stores up in its home considerable quantities of food for use during inclement weather. It may be said in this connection that with one exception the only specimens of pine mice procured by the writer in southern New York were taken from the storehouses of this Owl.

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* Mr. William Brewster (Auk, vol. VIII, 1891, pp. 140–144) divided this race into three subspecies. Typical *kennicottii* inhabiting the coast of Alaska from Sitka southward; *macfarlanei*, Fort Walla Walla, Washington, Hellgate, Montana, and probably the entire intermediate region, northward into the interior of British Columbia; and *saturatus*, the shores and islands of Puget Sound, ranging southward along the coast to Salem, Oregon. In the same paper (on page 139), a new race, *aikeni*, is described from El Paso County, Colorado.

Frogs are devoured greedily, while other batrachians and small reptiles are occasionally eaten. Crawfish are sometimes found among the stomach contents, but not so often as in the case of the Barred Owl. Evidence goes to show that at times this Owl is an expert fisherman. Capt. Charles E. Bendire found it feeding on fish in the Northwest, and the following note by Mr. M. A. Frazar, from Watertown, Mass., shows that it will sometimes travel a long distance for this food:

"On November 29, 1876, I took from a Mottled Owl's hole (*Scops asio*) the hinder half of a Woodcock (*Philohela minor*). Within two weeks after I took two Owls from the same hole, and on the 19th of January last I had the good fortune to take another. After extracting the Owl I put in my hand to see what else there was of interest, and found sixteen Horned Pouts (*Amiurus atrarius*), four of which were alive. When it occurred to me that all the ponds in the vicinity were under at least 2 feet of snow and ice, I could scarcely conjecture where the Horned Pouts could have been captured. After visiting all the ponds I found they had most probably been captured in one fully a mile away, where some boys had been cutting holes through the ice to catch pickerel bait. The Owl probably stationed himself by the edge of the hole and seized the fish as they came to the surface. What a busy time he must have had flying 32 miles after sixteen Horned Pouts." (Bull. Nutt. Ornith. Club, vol. II, July, 1877, p. 80.)

Mr. Willard E. Treat, of East Hartford, Conn., speaking of this habit, says: "I secured a Screech Owl February 2, 1889, which was caught in a steel trap, the latter having been set in a spring where there were a number of small fish. When found it was dead, having been drowned, and its legs were more or less covered with fish scales. The trap was at least 4 or 5 inches below the surface of the water, which seems to show that the Owl must have plunged into the water in order to have got caught. This is the only instance in which I have known this species to enter the water for the purpose of securing fish." (Auk, vol. VI, 1889, p. 189–190.)

No Owl except the Burrowing Owl is so destructive to noxious insects as this species, it devouring with relish grasshoppers, crickets, and a number of night-flying beetles. The stomachs of two young birds which had recently left the nest were found distended with May beetles. Prof. Samuel Aughey found remains of insects in all the specimens he examined in Nebraska, and states: "It is largely an insect-eating bird." Dr. B. H. Warren says: "During the summer months and at other times when insect life is abundant the Screech Owls subsist mainly on an insect diet." (Birds of Pennsylvania, 1888, p. 115.) During the years 1884 and 1885 Mr. Charles Dury received at least sixteen specimens from the vicinity of Cincinnati; twelve of these, including one killed in January, contained remains of insects.

Writers almost universally speak of the Screech Owl as a beneficial species:

"It preys on mice, small sparrows, etc., and very often catches nocturnal beetles and other insects. It thus destroys a large number of field mice and the large cockchafer, so injurious to our fruit trees. In winter it familiarly enters our barns and outhouses, where it becomes an expert and industrious mouser." (Dr. E. Michener, U. S. Agricultural Report, 1863, pp. 291–292.)

"The food is chiefly small quadrupeds, insects, and occasionally, when they have young, small birds. They destroy a vast number of mice, beetles, and vermin, and are of great service to the agriculturist." (Baird, Brewer & Ridgway, History of North American Birds, vol. III, p. 57.)

"After dark it is all alive; not a mouse can stir without being observed, and so quick and noiseless is the flight of the bird that few escape which expose themselves." (McIlwraith, Birds of Ontario, 1886, p. 158.)

"A large number of castings of this species were examined on various occasions, and found to be composed almost entirely of the fur and bones of meadow and white-footed mice; with feathers of bluebird and some sparrow in several cases; and sometimes insects." (Mr. J. Percy Moore, *in epist.*)

Mr. George C Jones, writing from Brookfield Center, Fairfield County, Conn., says: "I think the smaller species of Owls feed upon the cutworm to some extent. I have found cutworms in the stomach of the common Screech Owl and in the Long-eared Owl. The fact that both the cutworms and the Owls are nocturnal leads me to believe that the Owls, of all the birds, are the most efficient exterminators of this formidable pest and should on this account receive protection. "The farmers here are large growers of tobacco, and the damage done by the cutworm to the young plants and the labor of resetting forced upon the growers is almost incalculable. I believe that if our native Owls were as plenty as some other species of birds the ravages of this destructive worm would be much less than at present."

Unfortunately we can not shut our eyes to the blacker pages of its history, and it must be said that occasionally it is destructive to small birds, especially during the breeding season, when it has a number of hungry mouths to fill, and also in suburban districts where its favorite food is hard to procure. Mr. Morris M. Green found the remains of a house wren in a hole containing five young Screech Owls; and Nuttall says: "In the hollow stump of an apple tree, which contained a brood of these young owls, were found several bluebirds, blackbirds, and song sparrows, intended as a supply." (Land Birds, 1832, p. 121.)

Sometimes it kills birds fully as large as itself. In one of its holes the writer once found the remains of a quail; and a woodcock has been mentioned as found in a similar situation. Mr. R. E. Kimball, of Fitchburg, Mass., informed the writer that a Screech Owl was killed at Lunenburg, near that place, January 27, 1890, which had killed thirteen doves for one farmer before it was itself executed. Its stomach was filled with the feathers of the last victim. In a few instances it has been known to kill and eat one of its own kind. When suffering from the pangs of hunger it occasionally attacks barn-yard fowls.

"About 3 o'clock on last Friday afternoon a common little screech owl flew into a large barnyard in this neighborhood and alighted on the back of a large hen, several times as large as itself, attempting to carry it off. The claws of the owl got entangled in the feathers of the frightened hen, and the owner of the farm was enabled to catch it. * * * There was scarcely any flesh on its bones and no signs of food in its stomach." ('Night Hawk': Forest and Stream, vol. XX, March 8, 1883, p. 106.) And Mr. J. L. Davison, of Lockport, N. Y., mentions a Screech Owl attacking a Plymouth Rock rooster. (Forest and Stream, vol. XXIV, March 19, 1885, p. 145.)

Unfortunate as this bird-catching habit seems to be, it may be ranked as an important factor in the bird's favor. Since the introduction of the noxious English sparrow, and its alarming increase in our cities and villages, experience has taught the little Screech Owl that this sparrow is a delicate and easily obtainable food. Many times at dusk has this Owl been seen hovering about the ivy-mantled churches or thick shrubbery of the parks in search of sparrows, and still more positive evidence is furnished by the remains of English sparrows which have been found in the stomachs of Owls shot in such localities.

On this subject, Mr. R. S. T. Russell, of Mount Perry, Ohio, writes to us as follows: "I want to send you a fact about the English sparrow. Last summer they were so thick around my house as to almost set me wild, when a little 'screech' owl got to visiting us every night, and at each visit he carried off a sparrow. My house is thickly covered with vines, and the little owl would make a dash into the vines and capture his sparrow every time. By fall they were well thinned out."

The following species of mammals and birds have been positively identified among the stomach contents:

MAMMALS.	BIRDS.
Sitomys americanus.	*Colinus virginianus.*
Sitomys eremicus.	*Megascops asio.*
Arvicola austerus.	*Otocoris a. praticola.*
Arvicola pinetorum.	*Junco hyemalis.*
Arvicola riparius.	*Ammodramus s. savanna.*
Mus musculus.	*Spizella monticola.*
Sciuropterus volucella.	*Spizella socialis.*
Tamias striatus.	*Melospiza georgiana.*
Perognathus.	*Melospiza fasciata.*
Neotoma floridana.	*Passer domesticus.*
Scalops aquaticus.	*Seiurus motacilla.*
Condylura cristata.	*Troglodytes aëdon.*

This Owl breeds throughout its range, and does not migrate or even wander far during the winter months. It almost invariably nests in the hollows of trees, usually not over 10 feet from the ground, old apple orchards being favorite resorts in thickly inhabited sections. Occasionally it has been known to breed in holes in buildings as well as in dovecotes, but never in nests among the branches of trees, as is the habit of some other Owls. Capt. Bendire once found a pair breeding near Fort Walla Walla in the same tree with a pair of Sparrow Hawks, and there seemed to be perfect harmony between the birds, although their holes were only about 2 feet apart. (Ornithologist and Oologist, vol. VI, 1881, p. 21.)

In the following case, noted by Mr. F. Stephens, the relations of the species were somewhat strained. Mr. Stephens states: "On April 19 I heard a screaming noise proceeding from a woodpecker's hole in a pine. I climbed the tree and pulled out a female McCall's Owl, and immediately after a male Sparrow Hawk flew out. The Owl was apparently breeding, but the hole contained no eggs." (Bull. Nuttall Ornith. Club, vol. III, 1878, p. 94.) Evidently the Hawk had been looking for a nesting site and had entered a tenanted one by mistake.

There never seems to be much of an attempt to form a nest; usually the cavity is incompletely lined with a few feathers from the parent bird, but this is by no means universal. The eggs, from three to six in number, are placed in the bottom of the cavity in the rotten wood and other material accidentally occurring there. In the South they are deposited in the latter part of March, while in the more northern States full sets are rarely found before the middle of April. If the cavity is large enough the male usually remains with the female during the day while she is sitting on the eggs; if it is not of sufficient size to accommodate both, he may be found in a neighboring hole or copse. About one month elapses from the time the first egg is deposited until all the young hatch, and they remain in the nest about the same length of time. Mr. F. H. Carpenter had a pair breed in confinement and gives the length of incubation as twenty-two days. (Ornithologist and Oologist, vol. VIII, 1883, pp. 93, 94.) In the latter part of May or first of June families composed of old and young sometimes may be started at dusk from the clumps of bushes bordering streams, or in the vicinity of old orchards.

The little Screech Owl is one of the most nocturnal of our species, seldom moving out of its retreat until twilight. Its flight is regular, and when indistinctly seen in the dusk it much resembles that of the woodcock. If suddenly started on a bright day it flies around in a bewildered manner, but soon becomes accustomed to the light and apparently sees perfectly well. During the day it usually remains hidden in the hollows of trees or more rarely among the thick foliage. Here it is occasionally espied by some keen-eyed songster prying in every nook and corner while in search of food. The little bird is not slow in making its discovery known to others in the neighborhood, who at the first note of alarm hurry to the spot. Soon an irritated mob, including perhaps a dozen species, surround poor *Megascops* and make life so uncomfortable that he is forced to seek another place, only to be followed and harassed by his tormentors. To escape these frequent indignities he chooses the dark cavities in hollow trees in preference to other and less secure hiding places.

During cold weather in the north it not unfrequently inhabits barns. Mr. McIlwraith, of Hamilton, Canada, states: "During some winters there is scarcely a farm in the country which has not its Screech Owl in the barn." (Birds of Ontario, 1886, p. 157.)

When kept in confinement the Screech Owl is one of the most interesting of pets, and although not so active on bright days as might be desired, it is usually so kind and affectionate as fully to compensate for its sluggishness. It soon learns to take food from the hand and will allow a moderate amount of handling by its master. It is very fond of water and will drink or bathe eagerly when a fresh supply is placed in the cage. Once about dusk the writer came upon a small family which had emerged the moment before from the water. They were sitting on some low alders over a shallow portion of the stream, ruffling up and shaking the water from their feathers, and presented a soaked and forlorn appearance. Apparently they were too wet to be able to fly well, for when approached they fluttered off heavily into the thicket and soon escaped from sight in the growing darkness. The number of times this Owl has been drowned in water barrels indicates its fondness for bathing. The following note by Mr. A. W. Anthony, of an incident in Washington County, Oregon, unquestionably refers to a bird caught while attempting to bathe: "One was caught in a steel trap set in a deep, narrow ditch. As the trap was sunk at least 4 inches under water, and was not baited, it is a puzzle to me how the bird was caught." (Auk, vol. III, 1886, p. 165.)

The low, wailing, moaning notes of this Owl are not loud, but their character enables them to be heard a considerable distance; they suggest, without resembling, those of the common dove. They may be heard at any time from dusk to dawn, and on rare occasions in the daytime.

DESCRIPTION.

Toes more or less distinctly feathered or bristled on upper side. Ear tufts conspicuous. Plumage presenting two totally distinct phases, having no relation to sex, age, or season; one grayish, the other bright rufous; though birds from the Rocky Mountains and the Pacific Slope, south of the northwest coast region, are known only in the gray plumage. A more or less conspicuous bright-colored stripe runs along each side of the back, and a blackish line along the shafts of the feathers, sometimes throwing out transverse bars.

Length: 6.50 to 10 inches (165 to 254^{mm}); extent, 20 to 24 inches (508 to 610^{mm}); wing, 5.60 to 7.10 inches (142 to 180^{mm}); tail, 3 to 3.70 inches (75 to 94^{mm}).

Table showing the results of examinations of 254 stomachs of the Screech Owl (Megascops asio).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Sing Sing, N. Y	Aug. 31, 1885				Remains of insects.
Atlanticville, N. Y	Dec. 4, 1885			Mouse hair	
Sing Sing, N. Y	Sept. 25, 1886				Do.
Washington, D. C	Nov. —, 1886			Meadow mouse	
Do	do			2 white-footed mice.	Do.
Do	do				Do.
Do	do				Do.
Do	do			Mouse hair	Do.
Do	do		Tree sparrow		
Do	do				Do.
Do	do		Feathers		
Do	do			Mouse hair	
Do	do				Do.
River Vale, N. J	Nov. 20, 1885				Larvæ.
Bergen County, N. J	Nov. 26, 1885			House mouse	
Alfred Center, N. Y	Oct. 10, 1886			White-footed mouse.	Grasshopper, crickets, crawfish.
Peterboro, N. Y	Sept. 11, 1886		Sparrow	do	Grasshoppers.
Amherst, Mass	July 8, 1886				Frog, remains of insects.
Cleveland, Ohio	Mar. 12, 1886			Meadow mouse.	
East Hartford, Conn	June 23, 1886		3 small birds		7 beetles.
Gainesville, Fla	Mar. 12, 1887				Grasshoppers, larvæ of beetles.
Washington, D. C	Jan. —, 1887			White-footed mouse; meadow mouse.	
Do	do			2 meadow mice	
Do	do		Screech owl		
Do	do		do		
Do	Feb. 15, 1887			Mouse	
Rockville, Conn	May 28, 1887				Empty.
Do	do				Beetle.
Portland, Conn	Oct. 22, 1886				Spider.
Do	Dec. 23, 1886	Pigeon			
Lockport, N. Y	Jan. 7, 1888				Crawfish.
Portland, Conn	May 5, 1887				7 May beetles.
Washington, D. C	Feb. 13, 1887			2 pine mice	
East Hartford, Conn	July 16, 1886		2 English sparrows.		

Table showing the results of examinations of 254 stomachs of the Screech Owl (*Megascops asio*)—Continued.

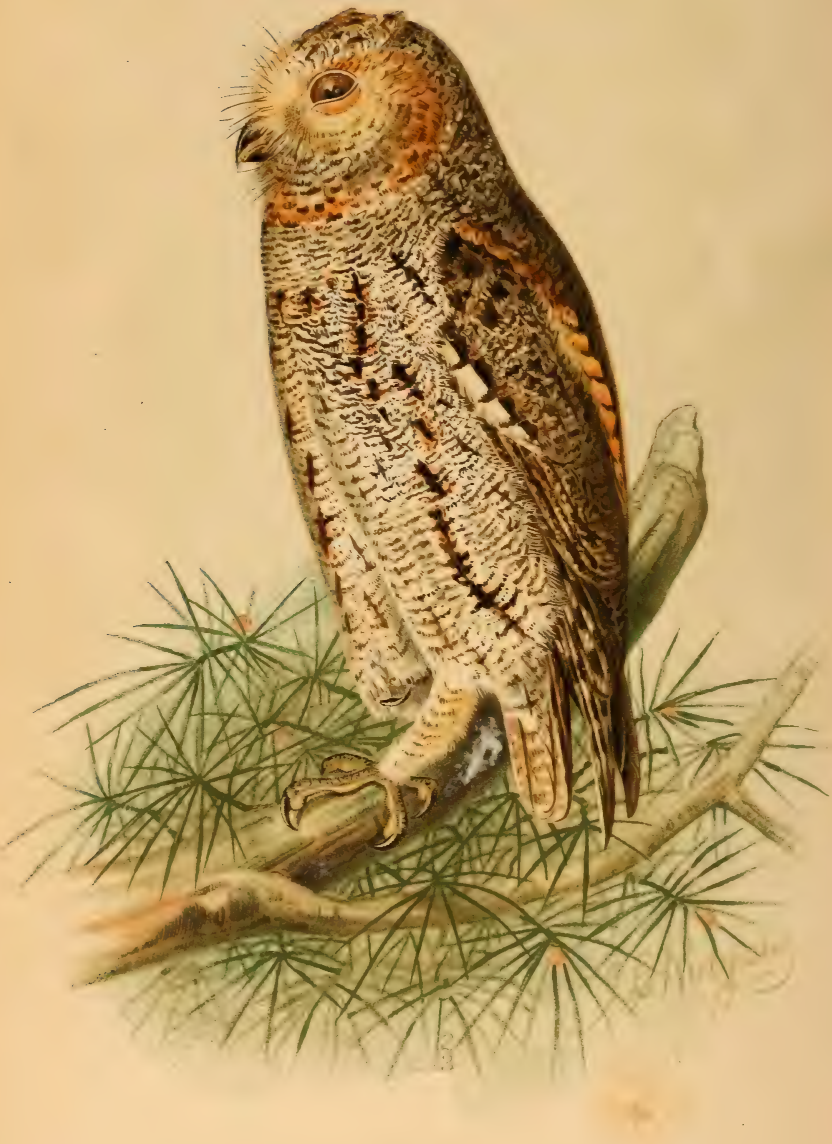
Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Philadelphia, Pa	Apr. 20, 1886				May beetles.
Greensboro, Ala					2 cicadæ.
Sandy Springs, Md	Mar. 2, 1887				Insects.
Do	do			2 mice	
Chester County, Pa	Jan. 11, 1886			Mouse hair	
Do	Jan. 5, 1886			House mouse	
Do	Apr. 22, 1886		Feather		Beetle.
Do	Jan. 7, 1887		Feathers		
Do	Jan. 8, 1887			House mouse	
Do	Nov. 10, 1887			Meadow mouse	
Do	1876			Meadow mouse, house mouse.	
Do	Nov. 27, 1886			White-footed mouse.	
Do	do				Empty.
Do	Dec. 6, 1886			Meadow mouse	
Do	Dec. 10, 1886				Beetles.
Do	do				Empty.
Do	Feb. 12, 1887				Indeterminate matter.
Do	Feb. 9, 1887			House mouse	
Do	Feb. 18, 1887			do	
Do	Jan. 15, 1887			do	
Do	Jan. 17, 1887			do	
Do	Dec. 27, 1886			Mouse hair	
Do	Jan. 11, 1887			House mouse	
Do	Feb. 9, 1887				Trace insects.
Do	Feb. 10, 1887				Empty.
Do	Jan. 17, 1887			Mouse hair	
Do	Feb. 11, 1887				Do.
Do	June 7, 1884				Insects.
Do	Jan. 8, 1885				Do.
Do	Jan. 6, 1885				Do.
Do	Dec. 18, 1886		English sparrow	Mice	
Do	Nov. 17, 1880		Small bird	do	
Do	Nov. 26, 1880			do	
Do	Aug. 20, 1876				Grasshoppers.
Delaware County, Pa	Dec. 5, 1879			Mice	
Cedar County, Nebr	Sept. —, 1867				47 locusts, 12 other insects.
Do	do		Small bird		32 locusts, 8 other insects.
Do	June —, 1868				41 locusts, 22 other insects.
Dakota County, Nebr	July —, 1869			Mouse	69 insects.
Do	Aug. —, 1870			do	38 insects.
Seward County, Nebr	Sept. —, 1872				67 insects.
Nemaha County, Nebr	Sept. —, 1874				50 locusts, 16 other insects.
Lancaster Co., Nebr	June —, 1875				49 locusts, 15 other insects.
Elmira, N. Y	Jan. 29, 1886		English sparrow	Mice	
Do	Jan. 30, 1886		Feathers	do	
Horseheads, N. Y	Feb. 4, 1886		English sparrow		
Chemung, N. Y	Mar. 7, 1886			Field mice	
Elmira, N. Y	Mar. 21, 1886			Mice (?)	
Barton, N. Y	Apr. 13, 1887		Junco		
Waverly, N. Y	Apr. 15, 1886				Insects.
Tioga, Pa	Oct. 5, 1886			Mice	
Wellsboro, Pa	Oct. 8, 1887		English sparrow		
Elmira, N. Y	Oct. 21, 1886		Shore lark		
Do	Oct. 23, 1886			Mice	
Do	Oct. 25, 1887		English sparrow		
Wellsburg, N. Y	Nov. 2, 1886				Empty.
Caton, N. Y	Dec. 24, 1887		English sparrow		
Washington, D. C	Mar. 25, 1888			Meadow mouse	Crawfish.
Do	do				Empty.
West Chester, Pa	Jan. 6, 1887			House mouse	
Raleigh, N. C	Feb. 16, 1888				Do.
Do	Aug. 27, 1888		Water thrush		Insects.
Do	Aug. 29, 1888				Do.
Do	Aug. 30, 1888				Do.
Do	Nov. 3, 1888				Do.
Do	Dec. 7, 1888				Do.
Do	Mar. 20, 1889			Mice	
Tracy Station, Ind	Feb. 12, 1887				Empty.
Brookville Ind	Mar. 26, 1887			Shrew	
Adams, Ind	Dec. 10, 1887				3 crawfish, minnow.

Table showing the results of examinations of 254 stomachs of the Screech Owl (Megascops asio)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Brookville, Ind	Dec. 31, 1887				
Troy, N. Y	Nov. 1, 1883			Mouse	
Do	Dec. 6, 1883				Empty.
Rensselaer County, N. Y.	July 13, 1882				Large beetle.
Do	Dec. 9, 1884			Mice	
Do	May 25, 1886		Sparrow		
Do	April 3, 1887		Feathers		
Do	Nov. 1, 1887				Empty.
Do	June 8, 1888				Do.
Stratford, Conn	Jan. 15, 1889				Indeterminate matter.
Gaylordsville, Conn	Feb. 14, 1889		Feathers		
Gold Hill, Colo	Summer, 1889			Meadow mouse	Crawfish.
Do	do				Crawfish, beetles.
Do	do				Crawfish.
West Goshen, Pa	Oct. 31, 1886			Mouse	Beetles, grasshoppers.
Morristown, N. J	Dec. 10, 1885			Meadow mouse	
Do	Dec. 5, 1885			Mouse	
Do	Nov. 28, 1885			Meadow mouse	
Lookout Mountain, Tenn.	Mar. 20, 1882				Large beetles.
Fort Hamilton, Long Island, N. Y.	Dec. 11, 1881			Mouse	
Schraalenberg, N. J	Nov. 26, 1885			Mice	
Cincinnati, Ohio	Apr. 10, 1884				Beetles.
Do	May 22, 1884				Do.
Do	Oct. 10, 1884				Do.
Do	Nov. 8, 1884				Millipedes.
Do	Nov. 24, 1884				Insects.
Do	Dec. 5, 1884			Mice	
Do	Dec. 11, 1884			do	
Do	Jan. 13, 1885				13 cutworms, millipedes.
Do	Jan. 25, 1885		English sparrow	Mice	
Raleigh, N. C	Jan. 18, 1886				Empty.
Do	Jan. 22, 1886		Feathers		Toad.
Do	Jan. 15, 1887				Beetle.
Do	Feb. 26, 1887				Insects.
Do	Feb. 16, 1888				Empty.
Washington, D. C	Apr. 29, 1888		Swamp sparrow	White-footed mouse.	Insects.
East Hartford, Conn	Nov. 3, 1887				Insect remains.
Do	Apr. 6, 1888			Mouse	
Washington, D. C	May 27, 1888				May beetles.
Do	do		Small bird		Do.
Do	do				Do.
Geneva, N. Y	Jan. 26, 1888				Empty.
East Hartford, Conn	Apr. 4, 1887				4 moths.
Do	Apr. 8, 1887		Feathers	Mouse	
Do	do				Empty.
London, Nebr	Sept. 8, 1888				2 grasshoppers.
Gordon, Tex	Sept. 9, 1888				5 grasshoppers, beetle.
Do	do				6 grasshoppers.
Sandy Spring, Md	Jan. 29, 1889				Empty.
Chester County, Pa	Mar. 1, 1889				Do.
Flatbush, N. Y	Jan. 13, 1889		Tree sparrow		
Oracle, Ariz	June 11, 1889				Do.
Do	do				Insect remains.
Washington, D. C	June 2, 1889			Star-nosed mole.	3 May beetles.
Do	do				Grasshopper, cricket.
Do	do				Tree toad, burying beetle, 5 lepidopterous larvæ, 4 grasshoppers, 1 hellgrammite.
Cold Spring, Suffolk County, N. Y.	May 19, 1889		Song sparrow	White-footed mouse.	Beetles.
Washington, D. C	Aug. 28, 1889				Grasshoppers, beetles.
Alfred Center, N. Y	Oct. 2, 1889			Flying squirrel.	Grasshoppers.
Hale County, Ala	Nov. 13, 1889				2 beetles.
Vineland, N. J	Feb. 15, 1889			2 house mice	
Sandy Spring, Md	Jan. 19, 1890				Empty.

Table showing the results of examinations of 254 stomachs of the Screech Owl (Megascops asio)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Ercildoun, Pa	Dec. 25, 1889				Small insects.
Do	Feb. 14, 1889				Empty.
Selden, N. Y	Aug. 8, 1889			Meadow mouse.	
Glen Head, N. Y	Nov. 15, 1888				30 larvæ.
Huntington, N. Y	Nov. 25, 1889				Sand, vegetable matter.
Highland Falls, N. Y	Oct. 24, 1874				Empty.
Do	May 30, 1875				Do.
Do	June 1, 1875				Do.
Do	June 2, 1875				Do.
Do	Dec. 8, 1875			White-footed mice.	
Do	Dec. 27. 1880				Empty.
Do	Jan. 21, 1883				Do.
Do	Apr. 25, 1883				Do.
Do	May 14, 1883			Hair	Insect remains.
Camp Verde, Ariz	June 5, 1884			Hair of small mammals.	
Picacho Station, Ariz	May 9, 1885			Remains small mammals.	
Casa Grande, Ariz	May 10, 1885				Flesh.
Do	May 10. 1885				Do.
Picacho Station, Ariz	May 24, 1885			Remains small mammals.	
Do	May 26, 1886			Hair of small mammals.	
Camp Verde, Ariz	June 6, 1885				Empty.
Do	July 6, 1885				Grasshoppers.
Do	Apr. 27, 1886			Desert mice	
Do	Sept. 14, 1886				Empty.
Do	Nov. 28, 1886				Do.
Do	Oct. 12, 1887				Spiders, insects.
Washington, D. C	Aug. 10, 1890		Chipping sparrow.		
Do	do				10 larvæ.
Plover Mills, Ontario	Sept. 29, 1884				2 crickets.
London, Ontario	Oct. 29. 1890			2 white-footed mice.	2 craw fish, 1 larva.
Portland, Conn	Oct. 10, 1890				Empty.
Oxford, Ohio	do			1 meadow mouse, 2 house mice.	Beetles, grasshoppers.
Sandy Spring, Md	Nov. 16, 1890			Mouse	Insects.
Tanque Verde, Ariz	Mar. 30, 1890			do	12 grasshoppers, 1 scorpion, beetle.
Do	do		Bird	2 mice	8 grasshoppers.
Do	do			Mouse	Lizard, scorpion, 10 grasshoppers, 2 beetles.
Washington, D. C	Nov. 27, 1890			Meadow mouse	
Sandy Spring, Md	Nov. 29, 1890			House mouse	
Morristown, N. J	Oct. 2, 1890				3 crickets, 2 katydids, earthworms, 2 larvæ.
Union County, Ky	May 19, 1890				Beetle.
Fairfax County, Va	Dec. 21, 1890		Swamp sparrow.	House mouse	
Do	do			2 house mice	
Washington, D. C	Dec. 14, 1890			House mouse	
Morristown, N. J	Oct. 25, 1890				12 caterpillars, 1 earthworm, beetle, crawfish.
Do	Oct. 25, 1890				10 caterpillars, spider, grasshopper, 2 cave crickets.
Flatbush, N. Y	Mar. 23, 1890				Empty.
Seldon, N. Y	Apr. 21, 1890				Do.
Do	do				Do.
Sugar Grove, Ohio	Oct. 17, 1890				Beetle remains.
Brookland, D. C	May 28, 1891				20 May beetles, 1 spider, 2 caterpillars.
Buffalo, N. Y	Dec. 13, 1890				Empty.
Do	Jan. 26, 1891				Do.
Do	Aug. 6. 1890			2 meadow mice	
Do	Dec. 13, 1890				Do.



DWARF SCREECH OWL

Megascops flammeolus idahoensis Merriam

A. Hoen & Co. Lithocaustic Baltimore.

Table showing the results of examinations of 254 stomachs of the Screech Owl (Megascops asio)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Keokuk, Iowa	Dec. 14, 1885			House mouse	
Alton, N. J	Nov. 26, 1890			1 white-footed mouse, 1 pine mouse.	Grasshopper remains.
Do	Dec. 1, 1890				Frog.
Hanover, N. J	Dec. 3, 1890			Meadow mouse	
Do	Dec. 4, 1890				Empty.
Alton, N. J	Jan. 14, 1891			Mouse hair	
Do	Feb. 16, 1891			do	
Do	Mar. 2, 1891			do	
Sandy Spring, Md	Dec. 15, 1891			do	
Lancaster County, Pa	Nov. 27, 1891		English sparrow		5 cave crickets, beetle, 2 spiders.
Do	Dec. 7, 1891		2 English sparrows.		
Do	Dec. 14, 1891				Empty.
Do	Nov. 19, 1891			House mouse	
Do	Nov. 26, 1891				Do.
Do	Dec. 15, 1891				Insect remains.
Do	do				Do.
Four-Mile Run, Va	Feb. 14, 1892				Empty.
Portland, Conn	Jan. 14, 1887			Mouse hair	
Do	Apr. 1, 1892				Do.
Marshall Hall, Md	May 30, 1892				Beetle remains.
Do	do				Insect remains.
Do	do				8 beetles, 1 lizard.
Do	do				3 May beetles, 1 lizard.
Liberty County, Ga	Apr. 14, 1892			White-footed mouse.	
Easton, Md	Dec. 17, 1891			House mouse	Small beetle.
Sandy Spring, Md	Jan. 12, 1891		Junco	Mouse hair	
Do	Jan. 16, 1892		Sparrow	House mouse	
Washington, D. C	Jan. 24, 1892			do	
Galena, Mo	July, 1892			Wood rat	Beetles.
Virginia				Small piece of flesh.	Do.
Do				do	
Bakersfield, Cal	July 20, 1891				Grasshoppers, spider.
Visalia, Cal	July 24, 1891				Grasshoppers, beetles.
Falls Church, Va	Feb. 22, 1892		Junco	Meadow mouse.	
Ithaca, N. Y	Mar. 14, 1892			Chipmunk	

SUMMARY.—Of 255 stomachs examined, 1 contained poultry; 38, other birds; 91, mice; 11, other mammals; 2, lizards; 4, batrachians; 1, fish; 100, insects; 5, spiders; 9, crawfish; 7, miscellaneous; 2, scorpions; 2, earthworms; and 43 were empty.

FLAMMULATED SCREECH OWL.

Megascops flammeolus.

[Plate 26—Megascops flammeolus idahoensis.]

This Owl inhabits the highlands of Central America and Mexico, ranging northward into the United States as far as California, Idaho,* Texas, and Colorado. It was first captured within our limits at Fort Crook, Cal., in August, 1860, and at the present time is one of the rarest Owls in the United States. More specimens have been taken in Colorado than in all the other States, and so far this is the only region where it has been found breeding.

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* Since the above was written Dr. Merriam has described the specimen which he secured at Ketchum, Idaho, as a new race under the name of *Megascops flammeolus idahoensis.* (N. A. Fauna No. 5, 1891, p. 96.)

From the little that is known of its habits it is presumed that they do not differ in any marked degree from those of the Common Screech Owl. Its food also is probably the same, although the only data we have on this subject is the result of examinations made by Dr. C. Hart Merriam, of the stomach contents of two specimens killed by him in the Grand Cañon of the Colorado September 13, 1889, and at Ketchum, Idaho, September 22, 1890. The stomach of the former contained one scorpion, some beetles, and a few other insects, and that of the latter, grasshoppers, ants, and other insects.

DESCRIPTION.

Toes entirely naked to extreme base. Ear tufts small; above, finely mottled grayish, with small, irregular black stripes, and blotches of orange rufous; below, whitish, with streaks and transverse bars of blackish. Wings, 5.10 to 5.60 inches (130 to 142^{mm}); tail, 2.60 to 3 inches (65 to 75^{mm}).

GREAT HORNED OWL.

Bubo virginianus.

[Plate 24—Adult.]

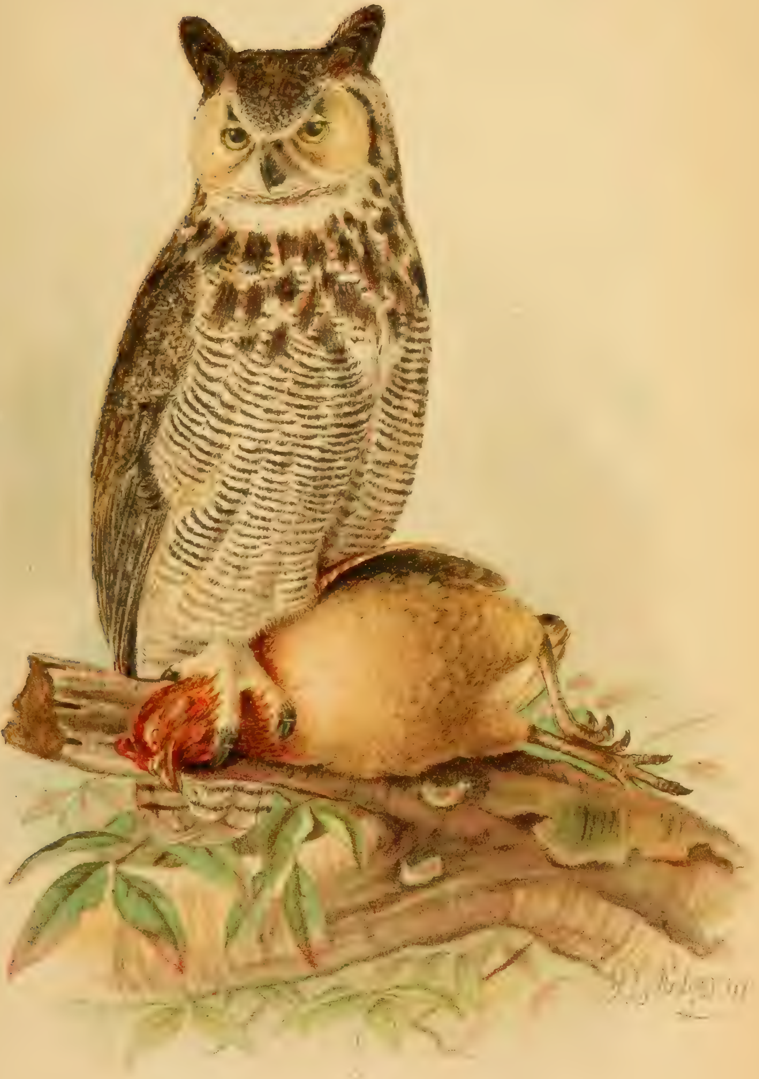
The Great Horned Owl is found in suitable localities throughout the greater part of North America, Costa Rica, so far as known, being the southern limit of its range. Like other birds and mammals which have a wide and diversified range, this species is modified by climate and other local influences so that it is separable into several well-marked geographical races. The typical form (*Bubo virginianus*) ranges from Labrador and the eastern United States south through eastern Mexico to Costa Rica.

The Dusky Horned Owl (*Bubo v. saturatus*) inhabits the northwest coast region from Oregon to Alaska, and also Labrador; recently it has been found to extend south through the Rocky Mountains to Colorado and Arizona (N. A. Fauna, No. 3, 1890, p. 91).

The Western Horned Owl (*Bubo v. subarcticus*) inhabits the western United States (except the northwest coast), ranging eastward across the Great Plains (straggling to northern Illinois, Wisconsin, and western Ontario), northward to Manitoba, and southward over the table-lands of Mexico.

The Arctic Horned Owl (*Bubo v. arcticus*) inhabits Arctic America, chiefly in the interior, ranging south in winter to Manitoba and the mountains of Dakota and Montana.

In studying this Owl in relation to its food habits it will be perceived at a glance that a bird so powerful and voracious may at times be a source of great benefit, while at other times it may be the cause of great damage. Now, the serious inroads it makes on the tenants of the poul-



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try yard, as well as the destruction of many game and song birds would seem to call for the total suppression of the species. Again, when engaged chiefly in the capture of injurious rodents, which threaten the very existence of the crops, it is the farmer's most valuable ally and consequently should be most carefully protected.

The food of this species is of great variety ; birds and mammals as well as reptiles, fish, crustaceans, and insects contribute to its fare. Among the birds most often taken may be mentioned all kinds of poultry (including half-grown turkeys), grouse, quail, doves, and wild ducks. Even hawks, crows, and other owls do not escape the voracity of this tiger among birds, and the large hawks are among those attacked and eaten.

Of all the birds of prey, with the exception possibly of the Goshawk and Cooper's Hawk, the Great Horned Owl is the most destructive to poultry. All kinds of poultry seem to be taken, though when Guinea fowls and turkeys are obtainable it shows a preference for these. In sections of the country where it is common the inhabitants often complain bitterly of its ravages. An examination of the table at the end of this article will show that a large proportion of the specimens contained the remains of poultry.

The following from Dr. B. H. Warren's report on the birds of Pennsylvania (p. 118) shows a still larger proportion of this class of food: "My own records of sixteen examinations of Great Horned Owls, which, with one exception, were taken during the winter months, revealed in eleven individuals only remains of poultry; two others, portions of rabbits, and of the three remaining birds of this series it was found that one had taken two mice; another showed small amount of hair, apparently that of an opossum. The sixteenth and last bird contained a mouse and parts of beetles."

The following, from the pen of Dr. P. R. Hoy, shows how destructive a single Owl may be: "The specimen in the collection of the academy was known to carry off from one farm, in the space of a month, not less than twenty-seven individuals of various kinds of poultry before it was shot." (Proc. Phila. Acad. Nat. Sci., vol. VI, 1853, p. 307.)

Dr. C. Hart Merriam gives the following account of its depredations: "Indeed I have known one to kill and decapitate three turkeys and several hens in a single night, leaving the bodies uninjured and fit for the table." (Birds of Connecticut, 1877, p. 97.) This preference for the heads of their victims is more or less common to all birds of prey, as is shown by the universal habit of eating this part first.

In portions of the country where game birds are common the depredations among them are nearly, if not fully, as great as in the poultry yard. Ruffed Grouse particularly seem to suffer, probably on account of their conspicuous size. Mr. E. E. Seton found two Ruffed Grouse and a hare in the nest of this species in Manitoba. (Auk, vol. II, 1885, p. 21.) A number of stomachs recorded in our table contained the remains of this noble game bird. Domesticated pigeons sometimes seem to be particularly agreeable to the Owl's taste and the neighboring dove cotes suffer correspondingly.

The rabbit undoubtedly stands at the head of the list of the mammals most often fed upon by this Owl. In fact its great love for the flesh of rabbits is one of this Owl's redeeming qualities. In some parts of the West, where rabbits are so numerous that it is next to impossible to bring to maturity any large proportion of the crops, this Owl feeds on this destructive rodent almost to the exclusion of other food. The examination of a number of stomachs revealed the fact that even in the East, where rabbits are not so abundant, their remains constitute a fairly large proportion of the contents. The writer is of the belief that where rabbits are comparatively abundant the species under consideration rarely molests poultry, and is a prime factor in destroying these destructive rodents.

Dr. W. S. Strode, in an article on 'The Food of the Owls' in the American Naturalist for January, 1889, states that the principal food of this Owl in the Spoon River country, Illinois, is small rodents, chiefly the gray rabbit. In seven nests examined the remains of at least a dozen rabbits were found.

Gophers, or more correctly speaking, spermophiles or ground squirrels, which furnish food for so many kinds of rapacious birds and mammals in the West, must afford a never-failing supply of food for this Owl in some regions. There is little direct testimony on the subject, but the great fondness this bird has for the arboreal squirrels in the East justifies this conclusion.

The Great Horned Owl has been often credited with being an expert ratter. The following extract from a letter from O. E. Niles to Charles Dury, of Cincinnati, furnishes very interesting and detailed information on the subject: "For many years I have personally known the value of our large Horned Owl as a 'ratter,' and will cite one instance in particular as proof. About eight years ago one of my men discovered a pair of owlets of the large-horned variety in an old sycamore stub near my stables on my farm, and concluded to capture them alive. With some risk to himself he succeeded in securing them, but not without a regular fight with the old ones, who gave him a few wounds. In the nest where he captured the young owls he noticed several full-grown Norway rats, with their skulls opened and the brain removed. On descending to the ground he also noticed the bodies of many rats around the tree, and out of curiosity counted them, and found the bodies of one hundred and thirteen rats, most of them full grown. They all appeared to simply have had their skulls opened and the brains removed; and, from their undecayed appearance, must all have been captured within the previous week or ten days." (Journal Cincinnati Soc. Nat. Hist., vol. VIII, April, 1885, p. 66.)

Among the mammals whose remains are less often found among the stomach contents may be mentioned muskrats, woodchucks, and opossums. It also feeds on mice and shrews, but to a much more limited extent than do the smaller Owls. In certain parts of its range, where the skunk is common, especially in the springtime, this animal forms a not uncommon article of food. Probably all collectors and taxidermists will bear out this assertion. Fully one-half of the owls skinned, if they do not at the time have the remains of this mammal in the stomach, give evidence of having been in contact with it by the strong scent on the plumage.

The late Dr. J. M. Wheaton, in his report on the birds of Ohio, 1882, sums up its food as follows: "The food of the Great Horned Owl consists of small quadrupeds, such as rats, mice, squirrels, and occasionally rabbits, birds, reptiles, and fish." (p. 407.)

An instance of its feeding on a porcupine is recorded by Charles R. Coombs (Ornith. and Oologist, vol. XIV, February, 1889, p. 29). The bird, which was killed at Castine, Me., was found to have the flesh and the roof of the mouth literally packed with the quills of this rodent. It is probable that the bird eventually would have succumbed to the effects of the quills, as do all mammals and birds, not excepting the panther, which are so voracious or shortsighted as to attack this sluggish animal. Nuttall mentions a case where a Great Horned Owl attacked a cat, which is of such interest that we embody it here: "My friend, Dr. Boykin, of Milledgeville, in Georgia, assured me that one of our own daring nocturnal adventurers, prowling round his premises, saw a cat dozing on the roof of a smokehouse, and supposing grimalkin a more harmless, rabbit-like animal than appeared in the sequel, blindly snatched her up in his talons; but finding he had caught a tartar, it was not long before he allowed puss once more to tread the ground." (Land Birds, 1832, p. 126.)

There are several species of Owls which show great fondness for fish when circumstances throw them in their way. A. M. Frazar found the ground under the nest of a Great Horned Owl literally strewn with fish scales. (Bull. Nutt. Ornith. Club, vol. II, 1877, p. 80.) William Brewster found in the stomach of an Owl killed at Tucson, Ariz., beetles, portions of crawfish, and a few fish scales. (Bull. Nuttall Ornith. Club, vol. VIII, 1883, p. 27.) Crawfish are eaten occasionally, but not so often as by the Barred Owl.

In our examination of stomachs we have never found the remains of batrachians, though doubtless they are sometimes used as food. Among insects the larger night-flying beetles are the ones most often taken.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Lepus americanus.
Lepus sylvaticus.
Lepus sylvaticus arizonæ.
Sigmodon hispidus arizonæ.
Thomomys talpoides umbrinus.
Thomomys clusius fuscus.

MAMMALS—continued.

Neotoma mexicana.
Neotoma cinerea.
Tamias dorsalis.
Onychomys torridus.
Onychomys leucogaster.
Sitomys eremicus.
Spermophilus grammurus.
Spermophilus harrisi.
Fiber zibethicus.
Fiber zibethicus arizonæ.
Sciurus niger ludovicianus.
Arvicola riparius.
Arvicola austerus.
Arvicola longicaudus.
Arvicola pauperrimus.
Arvicola mordax.
Blarina brevicauda.
Mus musculus.
Mus decumanus.
Vespertilio noctivagans.
Evotomys gapperi.
Sorex.
Sciuropterus volucella.
Perodipus ordii.

BIRDS.

Rallus crepitans.
Colinus virginianus.
Bonasa umbellus.
Tympanuchus americanus.
Accipiter cooperi.
Chondestes grammacus.
Junco hyemalis.
Mimus polyglottos.
Merula migratoria.

The Horned Owl breeds throughout its entire range, and is one of the earliest of the rapacious birds to commence family duties. In the southern part of its range the eggs are deposited in December and January, and in northern Alaska, Mr. Robert Kennicott found eggs in the early part of April. So cold was the weather at the time that the eggs were frozen while being carried to the fort. In the Northern and Eastern States it breeds in correspondingly cold weather, and in southern New York, in the month of February, the writer once observed icicles hanging from a nest which contained two eggs. Snow had fallen the previous day and probably had covered the setting bird as well as the rim of the nest. The warmth from the bird's body melted the snow, and the water which passed through the bottom of the nest soon congealed again in the frosty air and formed the icicles.

That this Owl does occasionally build its own nest is undoubtedly true, but in these sections, where old nests of hawks and crows are common, it usually remodels one of them and adds a sparse lining of evergreen leaves and feathers from its body as a finishing touch. The situation of the nest is varied. It may be placed among the branches of a tree or in a hollow trunk or limb. In the South the habit of nesting in hollow trees is much more common than northward, and, according to Mr. Maynard, it is a nearly universal habit with the bird in Florida. In the former case the nest is more or less bulky; when built in a hollow tree it is little more than a lining to the cavity. The nest is more often found in evergreen than in deciduous trees, and is usually placed in a crotch near the top. In localities where suitable trees are scarce the bird has been known to place its nest in even a crevice of a rocky cliff. The number of eggs in a set is usually two, though three or four are sometimes found. The period of incubation is, probably, about four weeks.

The young grow slowly and remain in the nest from ten to twelve weeks. Until four or five months old they retain considerable down, and it is probably not until August that they molt their first feathers and gain the full plumage.

After the breeding season the Great Horned Owl, like many others, will wander more or less in search of food, but at no time is there a migration which is at all comparable to that of the Snowy or Hawk Owls. Though a bird of retiring habits, this is one of the best-known species, from its large size, striking appearance, beautiful plumage, and particularly from the frequent forages it makes on the poultry yard. Although averaging a little less in measurement than the Snowy or Great Gray Owls, it is probably heavier than either.

It inhabits large wooded tracts, and where this character of country exists it is a common species. Like many other birds and animals it becomes scarce or disappears altogether from localities where the demands of agriculture cause the melting away of the forests and woodlands. In its forest home it finds not only more or less seclusion from the bright rays of the sun and from the worry of its numerous tormentors, but also the various mammals and birds upon which it chiefly subsists. Thus its abode is not only a citadel but also a well-stocked larder. Although it remains quiet on bright days, its vision is powerful in the strongest light. Any one who has ever attempted to stalk one of these Owls is well aware what a difficult task it is and how much better is the Owl's eyesight than his own. In dark, cloudy weather this species flies more or less at all times of the day, and in the breeding season it probably hunts day or night indifferently.

Dr. Coues, in the 'Birds of the Northwest,' relates that a couple of pet Owls watched without inconvenience two white cranes which were circling half a mile high in the direct line of the sun. Looking up to see what had attracted the bird's attention the doctor was nearly blinded by the intense light of the sun's rays.

In disposition the Horned Owl is fierce and untamable, and in point of strength and courage is inferior to none of our rapacious birds. It is so savage and seemingly so devoid of the confidence usually shown by the birds of prey kept in confinement that it is with the greatest difficulty that it can be tamed even when taken young from the nest. It is morose and sullen, lacks affection for its keepers, and often will fly viciously at anyone who attempts to handle it or enter the apartment in which it is confined. A notable exception to this untamable character are the two Owls above mentioned, belonging to Dr. Coues. They were kind and gentle and showed no impatience when handled, and were allowed their liberty at night, which they spent in foraging, but always returned in the morning.

DESCRIPTION.

Large and heavy. Ear tufts very conspicuous. Plumage irregularly varied with buffy, tawny, whitish, and dusky, one or other of these colors predominating in the different races. The buffy and tawny tints are most marked in the typical bird, the dusky in the dusky Horned Owl, and the white in the Arctic bird.

Length: 18 to 25 inches (456 to 635^{mm}); extent, 49 to 57 inches (1245 to 1448^{mm}); wing, 14.50 to 16 inches (368 to 406^{mm}); tail, 8.25 to 9 inches (210 to 229^{mm}).

Table showing the results of examinations of 127 stomachs of the Great Horned Owl (Bubo virginianus).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Chattanooga, Tenn	Dec. 25, 1885	Quail			
New London, Wis	Oct. 25, 1886			Fox squirrel	
Chester County, Pa	May 11, 1886	Guinea fowl.			
Adairsville, Ga	May 20, 1886				Beetle.
Lockport, N. Y	Jan. 2, 1887	Fowl			
Do		do			
East Hartford, Conn	June 16, 1887	do		Rabbit	
Sing Sing, N. Y	Jan. 19, 1883	Guinea fowl.			
Do	July 9, 1884	Fowl	Robin		
Do	Nov. 12, 1884			Shrew	
Do	Feb. 26, 1885			Rabbit	
Paint Rock, Tex	Apr. 23, 1887		Cooper's hawk, larkfinch, mocking bird.		
Sandy Spring, Md	Mar. 12, 1887	Pigeon		Meadow mouse.	
Chester County, Pa	Feb. 15, 1886			Rabbit	
Do	Sept. —, 1878	Poultry			
Dakota County, Nebr.	July —, 1869			Gopher	30 insects.
Elmira, N. Y	Oct. 4, 1885			Skunk	
Do	Oct. 7, 1886	Ruffed grouse.			
Corning N. Y	Aug. 15, 1884			Gray squirrel	
Tyrone, N. Y	Sept. 4, 1886	Poultry			
Elmira, N. Y	Nov. 5. 1885	do			
Breeseport, N. Y	Nov. 2, 1886			Rabbit	
Canton, Pa	Dec. 13, 1884			Skunk	
Tioga, Pa	Dec. 15, 1884			Weasel (?)	
Gaines, Pa	Dec. 29, 1885	Ruffed grouse.			
Elmira, N. Y	Jan. 3, 1884	Poultry.			
Do	Jan. 5, 1885				Empty.
Big Flats, N. Y	Jan. 17, 1886	Poultry.			
Erin, N. Y	Jan. 29, 1887	Ruffed grouse.			
Sandy Spring, Md	Apr. 7, 1888			Rabbit	
Raleigh, N. C	Mar. 9, 1888			do	
East Hartford, Conn	Nov. 23, 1887				Do.
Buffalo Gap, S. Dak	June 26, 1888			Rabbit, meadow mouse, grasshopper mouse.	4 beetles.
Sandy Spring, Md	Sept. 3, 1888			Rat, house mouse, meadow mouse.	Dung beetle.
Bridger Pass, Wyo	Sept. 9, 1888			Wood rat, meadow mouse, white-footed mouse.	Cuterebra.
Virginia	Oct. 23, 1888			Rabbit, silver-haired bat.	Spider, katydid.
Buckhannon, W. Va	Aug. 16, 1888			Rabbit	Maybeetle.
Fairmont, W. Va	Sept. 22, 1888				Snake.
Virginia	Nov. 22, 1888				Empty.
Suffolk county, N. Y	April 3, 1889			Rabbit	
Winnipeg, Manitoba	Feb. —, 1889			Hare	
Do	do			Red-backed mouse, shrew.	
Do	do			Hare	

Table showing the results of examinations of 127 stomachs of the Great Horned Owl (Bubo virginianus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Winnipeg, Manitoba	Feb. —, 1889			Hare	
West Vrginia	May 3, 1889			Rabbit	
Winnipeg, Manitoba	Mar. —, 1889			Hare	
Do	do				Empty.
Do	do			Hare	
Do	do			6 white-footed mice, 1 red-backed mouse, 4 shrews.	
Do	do			Hare	
Gold Hill, Colo	Summ'r, 1889			Rabbit (?)	
Owego, Tioga County, N. Y.	June 17, 1889				Offal.
Tuba City, Ariz	Sept. 23, 1889		Small bird		
Sandy Spring, Md	Oct. 12, 1889		Feathers		
Do	Nov. 20, 1889	Fowl			
Rensselaer County, N. Y.	Nov. 25, 1879	do			
Do	Nov. 2, 1880	do			
Washington County, N. Y.	Nov. 12, 1884			Hair	
Albany County, N, Y	Nov. 2, 1886			do	
Rensselaer County, N. Y.	Nov. 4, 1886			Muskrat	
Troy, N. Y	Nov. 12, 1886			Hair	
Brookville, Ind	Jan. 14, 1887				Empty.
Adams, Ind	Jan. 18, 1887				Do.
Union County, Ind	Jan. 8, 1888	Fowl			
Kalamazoo, Mich	——— , 1886			Rabbit	
Luck, Wis	Oct. 15, 1886	Fowl			
Concord, Mass	Apr. 22, 1877			Rabbit	
Chester County, Pa	May 20, 1882	Fowl			
St. Helena Island, S. C.	Feb. 26, 1886		Clapper rail	Marsh rabbit	
Cincinnati, Ohio	May 13, 1884	Feathers		Hair	May beetle.
Do	Nov. 20, 1884	Quail			
Do	Nov. 24, 1884	Fowl			
Ercildoun, Pa	Mar. 18, 1889		3 juncos	Rabbit	
Toronto, Ontario	Jan. 29, 1890			Short-tailed shrew.	
Greensboro, Ala	Jan. 23, 1890	Poultry			
San Francisco Mountain, Ariz.	Aug. 24, 1889				Grasshopper.
Rockland County, N. Y.	Mar. 14, 1880	Poultry			
Orange County, N. Y	Oct. 17, 1876				Empty.
Circleville, Ohio	Dec. 10, 1881			Rabbit	
Camp Verde, Ariz	Sept. 7, 1884				Do.
Do	Dec. 30, 1884			Cotton rat, wood rat, and pocket gopher.[*]	
Do	Jan. 1, 1885			Wood rats, cotton rats.	
Do	Jan. 3, 1885			Small mammals	
Do	Jan. 4, 1885				Do,
Do	do				Do.
Do	Feb. 9, 1885			Desert rabbit	
Do	Mar. 2, 1885			2 kangaroo rats	
Do	Sept. 3, 1885			Mice, pocket gopher, Gila chipmunk.	
Do	Sept. 17, 1885				Do.
Do	Oct. 28, 1885			2 Harris's chipmunks, grasshopper mouse.	
Do	Oct. 30, 1885			Wood rat, other remains.	
Do	Dec. 26, 1885			Desert mice, cotton rats.	
Do	Jan. 15, 1886			6 kangaroo rats.	
Do	May 14, 1886			Hair	
Do	Aug. 23, 1886				Do.
Do	Aug. 28, 1886			Rock squirrel, other rodents.	
Do	Aug. 30, 1886				Do.
Do	Dec. 26, 1886			Desert rabbit	
Do	Mar. 14, 1887			Muskrat	

[*] Dr. E. A. Mearns states that nearly all the specimens from Arizona which he examined had a strong skunky odor.

Table showing the results of examinations of 127 stomachs of the Great Horned Owl (Bubo virginianus)—Continued.

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Yavapai County, Ariz	May 20, 1887				Indeterminate matter.
Camp Verde, Ariz	Dec. 12, 1887			Cotton rats	
Do	Dec. 13, 1887			Small rodents	
Do	Feb. 15, 1888				Empty.
Do	Mar. 26, 1888				Do.
Do	Apr. 11, 1888			Muskrat, wood rat.	
Morristown, N. J	Apr. 28, 1890			Flying squirrel, rabbit.	
Clay County, S. Dak	Sept. 18, 1889	Fowl			
Do	Oct. 27, 1889			Rabbit	
Vermillion, Clay County, S. Dak.	Nov. 18, 1889	Wild duck.			
Do	Dec. 17, 1889				Do.
Do	Dec. 28, 1889			Muskrat	
Do	Feb. 17, 1890		Snowbird		
Do	Feb. 26, 1890	Prairie hen.		Meadow mouse	
Saw Tooth Lake, Idaho.	Sept. 30, 1890			2 pocket gophers, 1 white-footed mouse, 2 meadow mice.	
Keokuk, Iowa	Oct. 28, 1888		3 small birds		
Durand, Wis	May 31, 1885			Squirrel	
Do	do				Fish.
Union County, Ky	Apr. 3, 1890			Rabbit	
Do	Apr. 26, 1890			do	
Sabula, Iowa	Nov. 22, 1891			do	
Lancaster County, Pa	Nov. 10, 1891			do	
Do	Dec. 15, 1881			do	
Marshall Hall, Md	May 30, 1892				Dung beetle.
Sandy Spring, Md	Mar. 16, 1892				12 dung beetles.
Walker Basin, Cal	July 14, 1891			Wood rat	Scorpion.
Worcester, Mass	Mar. 26, 1892				Empty.
Montgomery County, Md.	Sept. —, 1892	Fowl			Beetle.

SUMMARY.—Of 127 stomachs examined, 31 contained poultry or gamebirds; 8, other birds; 13, mice; 65, other mammals; 1, a scorpion; 1, fish; 10 insects, and 17 were empty.

SNOWY OWL.

Nyctea nyctea.

This large and handsome Owl is circumpolar in its distribution, inhabiting the arctic portions of the northern hemisphere in summer and migrating south in winter. In North America it is rare west of the Rocky Mountains and south of our northern border, but in the East it is sometimes common as far south as the fortieth parallel, and as an accidental visitor nearly reaches the southern border of the United States. In Europe and Asia it extends south either regularly or accidentally to the British Isles, Holland, Belgium, Germany, southern Siberia, Turkestan, and Afghanistan.

It must not be understood that all or even any considerable portion of these Owls migrate very far south of their arctic home, for the birds which reach the United States or Southern Canada are but a small fraction of those which pass the winter near the northern line of trees. Although from some unknown cause, presumably the lack of food, there are sometimes quite extensive migrations along the eastern seaboard. For instance, in the winter of 1876–'77, in New England alone, Mr. Ruthven Deane knew of some 500 being seen, the majority of which were shot. (Bull. Nuttall Ornith. Club, vol. II, 1877, p. 10.)

It appears in the United States sometimes as early as October and a few occasionally remain until May. At Point de Monts on the north shore of the St. Lawrence River it has been taken as late as May 31, though the specimen was probably a pensioner. During migration flights of these Owls are observed sometimes far out to sea.

In the far north, lemmings and arvicoline mice furnish almost the exclusive food of this Owl in summer, but during the winter wanderings, when these mammals are not always obtainable, it takes what food it can get, such as fish, hares, muskrats, squirrels, rats, ptarmigans, ducks, or even offal.

From the following quotations it will be seen how universally this Owl depends on the lemmings for food:

Lieut. (now Gen.) A. W. Greely says: "Our observations agree with that officer [Maj. Feilden] to the effect that the food of this bird seems to consist entirely of the lemming." (Three Years of Arctic Service, vol. II, 1886, p. 381.)

Mr. Henry Seebohm says: "The lemming forms the Snowy Owl's chief food in the Far North, the range of both mammal and bird being generally the same; but other small rodents are taken, and it will sometimes attack Ptarmigan and Willow Grouse, or even the arctic hare. It is said occasionally to feed on fish." (Hist. British Birds, vol. I, 1883, p. 181.)

Mr. John Murdoch says: "Its abundance in the spring and summer near the coast appears to depend on the presence or absence of its favorite food, the lemming, as has been noted elsewhere by Mr. Nelson. During the season of 1882 we saw no lemmings, though signs of their presence in the shape of droppings, and their skulls and skeletons in the owls' castings, were numerous all over the tundra. During that season we saw but few owls. On the other hand, in 1883, lemmings were exceedingly plenty all around the station and owls were proportionately abundant; scarcely a day passed without one or more being seen sitting on the tundra, generally on the top of a bank or small knoll, on the lookout for lemmings." (Expedition to Point Barrow, Alaska, 1885, p. 107.)

Of the ten or twelve specimens which Dr. Leonhard Stejneger secured on Bering Island all except one contained the remains of arvicoline mice. The largest number found in the stomach of one individual was six, but in another the stomach was spoken of as 'crammed with arvicolæ,' so that probably it contained at least ten or fifteen mice. The extent of the dependence of this Owl upon mice is shown by a very interesting fact relative to the recent increase of the Owl on Bering Island, which the latter author records. Prior to 1870 there were no mice, and very few Owls ever visited the island. About this date the house mouse (*Mus musculus*) was introduced from ships and the Red-backed Mouse (*Evotomys rutilus*) in some unknown way. Twelve years afterwards he found the island swarming with mice and an abundance of resident Owls, affording a striking demonstration of the perfect workings of nature, for with the undue increase of any one species there occurs a corresponding increase of its natural enemies.

Dr. Stejneger says: "From * * * the contents of the stomachs, it would seem as if *Arvicola* was almost their only food. But it is only fair to state that I have seen this owl chase sea ducks, especially *Histrionicus histrionicus* out at the reef, very much in the same manner as does the falcon." (Bull. U. S. Nat. Mus., No. 29, 1885, p. 223.)

Mr. Thomas McIlraith, in 'The Birds of Ontario,' mentions one which made several attempts to capture a wounded duck, in which effort it probably would have succeeded had it not itself been killed. On the Mackenzie River, Richardson relates that one of the Owls was seen to fly over a cliff and carry off a full-fledged Duck Hawk in its claws, with which it alighted on the opposite bank of the river. The parent Hawk followed, uttering loud screams, and darting down struck the Owl, killing it instantly. Wilson and Audubon, who knew the bird only during its short winter visits, speak of its food as follows:

Wilson says: "The usual food of this species is said to be hares, grouse, rabbits, ducks, mice, and even carrion. * * * I met with this bird on Oswego River, New York State, a little below the Falls, vigilantly watching for fish." While according to Audubon, "Its usual food, while it remains with us, consists of hares, squirrels, rats, and fishes, portions of all of which I have found in its stomach. * * * In one of them I found the whole of a large brown rat, in pieces of considerable size, the head and tail almost entire."

Although most of the Owls will occasionally eat fish, this species seems to be especially fond of them, and when kept in confinement will eat them in preference to anything else except mice. Audubon describes the manner in which it catches fish, being an eye witness to the occurrence several times, and the following is what he says: "At the break of day one morning, when I lay hidden in a pile of floated logs at the Falls of the Ohio, waiting for a shot at some wild geese, I had an opportunity of seeing this owl secure fish in the following manner: While watching for their prey on the borders of the pots, they invariably lay flat on the rock, with the body placed lengthwise along the border of the hole, the head also laid down, but turned towards the water. One might have supposed the bird sound asleep, as it would remain in the same position until a good opportunity of securing a fish occurred, which I believe was never missed; for as the latter unwittingly rose to the surface near the edge, that instant the owl thrust out the foot next the water, and, with the quickness of lightning, seized it and drew it out. The owl then removed to the distance of a few yards, devoured its prey, and returned to the same hole; or, if it had not perceived any more fish, flew only a few yards over the many pots there, marked a likely one, and alighted at a distance from it. It then squatted, moved slowly towards the edge, and lay as before, watching for an opportunity. Whenever a fish of any size was hooked, as I may say, the owl struck the other foot also into it, and flew off with it to a considerable distance." (Ornith. Biography, vol. II, p. 136.)

The three specimens examined by Dr. B. H. Warren contained respectively the remains of a rabbit, of a rat, and offal.

The economic value of the Snowy Owl is limited, owing to the fact that it chiefly inhabits inhospitable regions where agriculture is impossible. Nevertheless, large numbers occasionally visit Canada and the United States, and it can not be doubted that during these visits its service to the agriculturist is beneficial. Mice and lemmings appear to be its chief dependence, and it takes them to the exclusion of all other food whenever it can get them. The number of useful birds it destroys is quite disproportionate to the number of injurious rodents to be credited to its account, and it is to be regretted that the snowy plumage of the bird and its showy appearance render it an object of pursuit for ornamental purposes.

The following species of mammals and birds were positively identified among the stomach contents:

MAMMALS.

Arvicola riparius.
Mus decumanus.
Sitomy samericanus.
Lepus sylvaticus.

BIRDS.

Colymbus auritus.
Colymbus holbœllii.
Simorhynchus pusillus.
Larus philadelphia.
Merganser.
Tympanuchus americanus.

The breeding range of this Owl extends from the limit of trees north to a point beyond that reached by any explorer. Maj. Fielden saw it in Grinnell Land at latitude 82° 40′, and Lieut. (now Gen.) A. W. Greely states that it bred abundantly in the vicinity of Fort Conger, latitude 81° 44′. It is resident through the northern part of Alaska, both on the islands and mainland. McFarlane did not find its nest at Fort Anderson, but it probably breeds in suitable localities in the interior south of that place, for it is reported as breeding in northern Labrador and Newfoundland. In exceptional cases, where it has been found breeding as far south as the latter places, the elevation of the locality compensates for the low latitude.

The eggs are deposited from the middle of May to the latter part of June, according to whether the locality is in the southern or northern part of the range, though Gen. Greely found eggs by May 25, and young as early as July 8. The number of eggs in a set varies from five to ten, and are deposited at intervals, so that when the last bird breaks the shell the oldest one is often nearly ready to fly.

The situation of the nest, if the few feathers, lichens, or moss composing it may be called a nest, is on some knoll slightly elevated above the surrounding country and usually occupies a slight depression in the ground. During the time the female is setting the male keeps guard and drives off any intruder, at times attacking even human beings. It the duty of the male to procure the food for the young, and the female apportions it among the family.

The bird is naturally very gentle in disposition and soon becomes tame in confinement. It has been taught to remain in the vicinity of its home and return to its master at the sound of a whistle. In the open country it is shy and very difficult to approach, though it is said to be less so in the wooded districts. The natives frequently decoy the bird near enough to shoot by attaching a bit of fur to the end of a string and allowing it to trail behind them as they walk; the Owl, thinking it a mouse, flies down to seize it, when the hunter turns around and shoots the bird.

The Snowy Owl is diurnal in its habits, but like most birds is more active in search of prey during the early morning and again toward dusk. Like many of the Hawks, it occupies a commanding perch for hours, watching what is going on about it, occasionally varying the monotony by dropping on a mouse or launching out over the broad country, soon to return to its perch. During its southern wanderings it is very partial to localities in the vicinity of water, especially the barren sand wastes along the seashore or extensive marshy flats bordering the bays and rivers.

Dr. William Wood states that he once knew one of these Owls to hide in a hollow apple-tree stub to escape the annoyance caused by a mob of crows following him, which ruse accomplished the desired result.

The flesh is light colored, somewhat resembling that of the chicken in appearance, and is very much relished by the Eskimo hunters. Thus this bird, unlike its congeners, has some value to humanity as a food.

The flight is firm, smooth, and noiseless, and may be long protracted. It is capable of rapid flight, and, according to Audubon, is able to capture ducks, pigeons, and even grouse on the wing, striking them down after the manner of the duck hawk.

DESCRIPTION.

Ear tufts rudimentary. Plumage pure white, sometimes almost unspotted, but usually marked more or less with transverse spots or bars of slaty brown.

Length: 20 to 27 inches (508 to 685^{mm}); extent, 59 to 62.50 inches (1500 to 1588^{mm}); wing, 15.50 to 18.75 inches (393 to 476^{mm}); tail, 9 to 10.30 inches (229 to 262^{mm}).

Table showing the results of examinations of 38 stomachs of the Snowy Owl. (Nyctea nyctea.)

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Washington, D. C.	Nov. 11, 1885				Empty.
Portland, Conn.	Nov. 20, 1885				Do.
Keokuk, Iowa	Dec. 6, 1886	Prarie hen.		Meadow mouse	
Lockport, N. Y.	Nov. 17, 1886				Do.
Do	do				Do.
Chester County, Pa	Dec. 14, 1886			House rat	
Dakota	Feb. —, 1889			3 white footed mice.	
Winnipeg, Manitoba	Mar. —, 1889	Wild duck.		Meadow mouse	
Do	do		2 feathers		
Do	do		Feathers		
Do	do			2 meadow mice, white-footed mouse.	
Do	do		Small finch	Meadow mouse, white-footed mouse	
Do	do			14 white-footed mice, 3 meadow mice.	
Sac County, Iowa	Dec. 28, 1882			Mouse	
Story County, Iowa	Feb. 7, 1882			Rabbit	
Matinicus Isle, Me.	Dec. 15, 1886		Large bird		
Do	do				Do.
Washington County, N. Y.	Feb. 25, 1887				Do.
Toronto Island, Ontario.	Dec. 28, 1889		Bonaparte's gull	Rat	
Do	Dec. 15, 1889			do	
Do	Dec. —, 1889			do	
Do	Dec. —, 1889			do	
Do	Jan. 3, 1890			White-footed mouse, 2 meadow mice.	
Montauk Point, N. Y.	Nov. 25, 1889			Meadow mouse	
Huntington, N. Y.	Dec. 17, 1889		Horned grebe		
Montauk Point, N. Y.	Dec. 12, 1889				Do.
Long Island, N. Y.	Dec. 1, 1875		Feathers		
Garden City, Long Island, N. Y.	Oct. 29, 1880				Do.
Vermillion, Clay County, S. Dak.	Nov. 18, 1889			White-footed mouse.	
Do	Feb. 26, 1890				Do.
Dover, N. J	Dec. 2, 1890				Do.
Do	Dec. 12, 1890			Rabbit	
Montauk Point, N. Y.	Dec. 5, 1890		Red-necked grebe.	5 meadow mice	
Do	do				Do.
Do	do			8 meadow mice	
Buffalo, N. Y	Feb. 28, 1891			Meadow mouse	
St. Paul Island, Bering Sea.	June 13, 1890		Least auklet		
Portland, Conn.	Dec. 12, 1890				Do.

SUMMARY.—Of 38 stomachs examined, 2 contained game birds; 9, other birds; 18, mice; 2, other mammals, and 12 were empty.

HAWK OWL.

Surnia ulula caparoch.

The typical form of the Hawk Owl inhabits the northern portions of the eastern hemisphere from Scandinavia to Kamtschatka, and occurs accidentally in western Alaska. Some authors consider the northern Siberian bird to be separable under the name of *Surnia u. doliata*.

The American bird (*Surnia u. caparoch*), which is merely a geographical race of the Old World species, inhabits the northern part of North America from Alaska and the central forest regions to Newfoundland, straggling south in winter to the northern United States, and rarely to the British Isles. Some winters it is quite common in Nova Scotia and in the vicinity of Quebec and Montreal, in Manitoba and northern Maine; south of these points it is merely accidental.

The food of this Owl varies considerably at different times of the year. In summer it feeds on the smaller mammals, such as mice, lemmings, and ground squirrels as well as insects of various kinds, while in winter, when the snow is deep and its favorite food is hidden, it follows the large flocks of ptarmigans and subsists on them. Dr. Dall seldom found anything but mice in the crops of those he dissected in Alaska, and the following from Dr. Coues mentions the same food: "It feeds chiefly upon the field mice (*Arvicolæ*) which swarm in the sphagnous vegetation of arctic lands; also upon small birds, grasshoppers, and other insects." (Birds of the Northwest, 1874, p. 312).

Dr. C. Hart Merriam, in speaking of its winter food, says: "In the vicinity of Hudson Bay during the winter season, the White Ptarmigan (*Lagopus albus*) constitutes its chief article of diet; and it is said to follow the hunter, pouncing upon his game before he has time to reach it." (Review of Birds of Conn., 1877, p. 73.)

Mr. Henry Seebohm speaks of its food as follows: "The principal food of the Hawk Owl is mice and lemmings; and the bird follows the migratory parties of the last-named little mammal to prey upon them. From its indomitable spirit, however, few birds of the forest are safe from its attack. In addition to the smaller birds which it captures, Wheelwright mentions the fact that he has seen the Hawk Owl strike down the Siberian Jay, and has also disturbed it feeding on an old Willow Grouse. The same naturalist has also taken insects from its stomach." (Hist. British Birds, vol. I, 1883, p. 184.)

It is said to breed in northern Maine; but if this be true, it must be a very exceptional or accidental occurrence. The true home of the species is from Newfoundland, Labrador, and northern Manitoba, northward through the evergreen forests to their limit in the Arctic Circle, the bird being more abundant toward the far north.

This Owl begins to deposit eggs, even in the far North, as early as the 1st of April; Mr. McFarlane found a nest containing six eggs in the Anderson River region April 28. Some individuals have eggs in latter part of June. The eggs may be placed indifferently in cavities of trees, in old nests among the branches, which are relined with moss and feathers, or more rarely among the inequalities in the face of cliffs. When the eggs are deposited in old woodpecker burrows or natural cavities, no nesting material is used other than the chips and powdered wood at the bottom of the cavity. The number of eggs vary from four to eight and, as is the case with many other Owls, the parent begins to set as soon as the first egg is laid; thus each egg is in a different stage of incubation. Both birds take part in the duties of rearing the young, and while the female is covering the eggs the male is near by to defend

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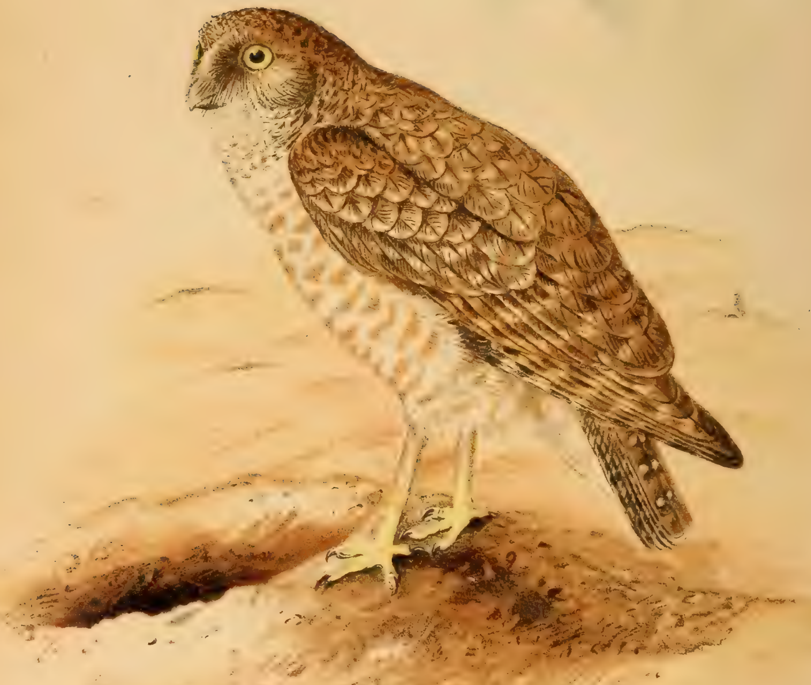

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the home. After the young leave the nest the family generally remain together until the following spring.

The species is tame and unsuspicious and may be approached easily without being alarmed; in fact, specimens have been known to return to the same perch after being shot at two or three times. It is a courageous bird and will defend its nest against all intruders. A male once dashed at Dr. Dall and knocked off his hat as he was climbing to the nest; other similar accounts show that the courage displayed on this occasion was not an individual freak, but a common trait of the species.

The Hawk Owl is strictly diurnal, as much so as any of the Hawks, and like some of them often selects a tall stub or dead-topped tree in a comparatively open place for a perch, where it sits in the bright sunlight watching for its prey.

Although the flight is swift and hawk-like, it has nevertheless the soft, noiseless character common to the other Owls, when starting from any high place, such as the top of a tree, it usually pitches down nearly to the ground, and flies off rapidly above the tops of the bushes or high grass, abruptly arising again as it seeks another perch.

The note is a shrill cry which is uttered generally while the bird is on the wing.

DESCRIPTION.

No ear tufts; tail rounded at tips, and indistinctly barred with white. Top of head and back of neck spotted with white and black, or dark brown; a patch of uniform blackish or dark brown on each side of hind neck. Upper parts brown more or less spotted with white; lower parts regularly barred with brown.

Length: 14.75 to 17.50 inches (375 to 445^{mm}); extent, 31 to 33 inches (787 to 838^{mm}); wing, 7.50 to 9 inches (190 to 228^{mm}); tail, 6.80 to 7 inches (172 to 178^{mm}).

Table showing the result of an examination of 1 stomach of the Hawk Owl (Surnia ulula caparoch).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Quebec, Canada	Jan. 15, 1886	....	....	Meadow mouse .	....

BURROWING OWL.

Speotyto cunicularia hypogæa.

[Plate 25—Adult.]

The genus to which the Burrowing Owl belongs is peculiar to America, and, although it includes but one species, the latter is divided into several geographical races, which are distributed over a considerable expanse ot territory. The typical form (*Speotyto cunicularia*) is found in southern South America, inhabiting the Argentine Republic, Chile, Paraguay, and probablys outhern Brazil. The North American form (*Speotyto c. hypogæa*) inhabits the plains region of the western part of the continent from British Columbia south to Guatemala, and east to Dakota, Nebraska, Kansas, Indian Territory, and Texas. An isolated race (*Speotyto c. floridana*) inhabits Florida and the adjacent Bahama Islands. Several insular races inhabit the West Indies, where *Speotyto c. guadeloupensis* is found on the islands of Guadeloupe and Nevis, *Speotyto c. dominicensis* on Santo Domingo, and *Speotyto c. amaura* on Antigua.

Except in the northern part of its range, where it is migratory in winter, the species is resident wherever found. Capt. Bendire states that at Fort Walla Walla, Washington, it returns in spring, about the middle of March, the males, as with other species, coming first. The many statements made respecting its supposed habit of hibernation prove to be incorrect, as numbers of careful observers have shown their falsity. Its habit is to forage in calm weather and to collect and store enough food to last through a stormy spell, when it stays in the burrow; it is this latter fact that has given rise to the erroneous idea that it hibernates.

In early twilight, when in search of food, this Owl may be seen hovering in the air after the manner of the Sparrow Hawk, and dropping on its prey when it is discovered.

This species not only appropriates the burrows of the prairie dog and ground squirrel for its home, but also feeds upon the young of the former as well as the adult and young of the latter. That it will kill and eat the larger species of spermophiles has been clearly demonstrated by Capt. Bendire, and the following is an account of his experiment: "In this vicinity [Walla Walla] these owls seem to live to a great extent on that pest of the farmer, Townsend's Ground Squirrel (*Spermophilus richardsoni townsendii* Allen), which would be much more destructive if not kept down by these owls. In order to satisfy myself that they were actually able to kill adult squirrels, I trapped several and placed them alive (they had been caught in a wire trap and were not at all injured) in a room with a pair of these owls. As soon as noticed by the latter one of them would fasten its talons into the squirrel's back, and with a few well-directed strokes of its beak, break the vertebræ of the neck and eat the head of the squirrel, often before the latter was quite dead; yet the remainder of the body was usually left and devoured later. I was surprised to see how easily they killed these squirrels, which made scarcely any resistance. Aside from these, their diet seems to consist of different species of mice, pocket gophers, as well as of crickets, grasshoppers, and occasionally even of fish. It is astonishing how much one of these owls will eat in a day, amounting often to considerably more than their own weight." (Ornithologist and Oologist, vol. VI, 1881, pp. 41, 42.)

Almost all species of mice which are common where the Owl abounds furnish at certain times of the year a considerable proportion of its food. Nearly all authors who mention its food enumerate mice as more often found in the stomachs examined than any other kind.

Dr. Agersborg gives the following relating to its food habits in southeastern Dakota in winter: "In the winter as many as twenty of these birds may be found nestling together in one hole. They are always at such times abundantly supplied with food. I have found at one time forty-three mice and several shore larks scattered along the run to their common apartment. They forage in fine weather and retreat to their dirty adobes when cold weather threatens." (Auk, vol. II, 1885, p. 284.)

This is one of the few instances in which it has been found to have killed birds, though the rigors of a Dakota winter, with the accompanying difficulty in procuring its favorite food, might be accepted as a partial excuse. Not so the case recorded by William Lloyd from western Texas, where the remains of Bell's vireo, savanna sparrow, and other birds were found in their holes. (Auk, vol. IV, 1887, p. 190.) Mr. Ridgway, Capt. Bendire, and others have found frogs in its burrows among other articles of food. In the case cited by Mr. Ridgway it was a love offering from the male to his mate, and must have been her favorite tidbit, if we may reason from analogy. Both Dr. Coues and Prof. Aughey report finding the remains of lizards among the stomach contents, so that probably, when available, any of the smaller reptiles or batrachians are taken. It is not unlikely that small rattlesnakes are sometimes eaten by this bird. The following, from Mr. C. S. Canfield, shows at any rate that it is fond of snakes: "In the passage leading to the nest there were small scraps of dead animals, such as pieces of the skin of the antelope, half dried and half putrefied, the skin of the coyote, etc.; and near the nest were the remains of a snake that I had killed two days before, a large *Coluber* (?) two feet long. The birds had begun at the snake's head, and had picked off the flesh clean from the vertebræ and ribs for about one-half of its length; the other half of the snake was entire." (American Nat., II, 1869, p. 585.)

In this connection an incident observed by Mr. H. W. Henshaw will be interesting. While on the Tulare plains, in southern California, he saw one of these Owls attack, with every demonstration of hate, a large bull snake (*Pituophis*). The snake was making its way slowly from one hole to another when the bird spied it. Immediately it rose into the air and, swooping down, made a feint as if to seize the reptile in its talons, swerving off, however, when within a foot or so. The snake apparently was more annoyed than frightened, but as rapidly as possible made its way out of the uncomfortable neighborhood. In this instance, at least, the attack by the Owl seems to have been actuated through fear of a hated enemy rather than by any hope of making it a prey; it may be doubted if the strength and courage of the Burrowing Owl are sufficient to enable it cope with a snake of any considerable size.

In the summer and fall, when grasshoppers and crickets are exceedingly abundant on the Western plains, the Burrowing Owl feeds almost exclusively on such food. Like the Sparrow Hawk, and even others of the larger diurnal birds of prey, this little Owl will chase and devour grasshoppers until its stomach is distended to the utmost. In all the stomachs the writer has examined, which were collected mainly in Dakota and Nebraska, the remains of grasshoppers or crickets were always found.

Prof. Aughey, whose investigations were carried on during the season when these insects were most abundant, found that the larger proportion of the stomach contents consisted of their remains. Beetles, dragon-flies, and the larvæ of various kinds of insects are eaten occasionally by this species.

William Lloyd writes that in several specimens dissected at Paint Rock, Tex., remains of myriapods were found. Other cases have come to our notice where it was seen feeding on scorpions and centipeds. A gentleman in Arizona found a pile of fragments of scorpions on the corner of the roof where a Burrowing Owl habitually carried its prey to devour it.

The writer found a number of molecricket scorpions (*Datames sulfurcus*) in the stomach of a Burrowing Owl secured in Walker Pass, Cal.

It will thus be seen that there is good reason for the almost universal belief in the beneficial habits of the Burrowing Owl. It destroys immense numbers of noxious insects, mice, ground squirrels, as well as scorpions and centipeds, and rarely molests the smaller insectivorous birds. There would seem to be no excuse for a failure to effectually protect it by law. Bounties offered for Hawks and Owls, however, often result in the destruction of great numbers of this species, so valuable to the agriculturists. More shameful still is the fact that it has been slaughtered and sold for millinery purposes.

Mr. Clark P. Streator informs us that in the year 1887 E. F. Lorquin, of San Francisco, Cal., received for millinery purposes, 500 Burrowing Owls and 1,000 specimens of other species of Owls and Hawks, besides hundreds of other birds.

The Burrowing Owl is terrestrial, inhabiting the treeless, grassy plains and deserts, dwelling in the abandoned burrows of various species of mammals as well as those of the land tortoises and larger lizards. Among the mammals whose deserted burrows are used by this bird may be mentioned prairie dogs, spermophiles, woodchucks, viscachas (South America), wolves, foxes, badgers, skunks, and armadillos. It will be seen from this extensive list that the Owl seldom wants for a home, as one or more of the above species are found in some part of its range. Various authors have stated that the bird sometimes excavates a burrow for itself, but there is no ground for the statement, for in no instance has it been observed in the work of excavation. It does not even share the habit of the rodents, which, after severe showers, carry out and place beyond the entrance of the burrow the loose earth which has washed in.

This species is strictly crepuscular and diurnal, and it possesses as keen vision and acute hearing as any of the Hawks. It is frequently in motion on the brighest days, capturing its prey or evading its pursuer with the greatest ease. Except in the breeding season it probably feeds more in early twilight than at other times. In many localities it is nearly impossible to approach within gun range, even where there is more or less shrubbery to conceal the collector, the noise which is necessarily made being sufficient to warn the bird of its danger. On the pampas in South America, according to W. B. Barrows (Standard Natural History), it is more nocturnal and does not feed or even move around much during the day. It generally remained a short distance inside the entrance of its burrow or sat on some low bush or mound. Neither was it difficult to approach in the daytime nor would it fly unless the intruder passed in close proximity. In the evening it was much more wary and would fly at the slightest noise, at the same time repeating its alarm note, which also warned the viscachas of danger. The alarm note, or note of rage, is a rattling, hissing sound which, according to Capt. Bendire, closely resembles that made by the rattlesnake.

The love notes of this Owl are peculiar and do not resemble those of any other species. They are produced in early twilight, not while the bird is on the wing but while it sits near the hole, and are repeated rather regularly for an hour or more.

Nathaniel H. Bishop likens the note to the sound produced by a frog; Dr. Coues states that the notes are curiously similar to those of the cuckoo, so much so that more than one observer has been deceived; and Capt. Bendire says they resemble those of the European cuckoo. The first observation refers to the South American species, while the last two are based on notes from the Western plains, which may account in part for the different interpretation of the sound.

The flight is rather laborious, irregular, and somewhat jerky, and is seldom of long duration. The bird rarely rises high in the air, but passes noiselessly along the ground, and when alighting drops very much after the manner of the woodcock. As a rule, when approached, instead of diving into and retreating to the far end of the burrow, it takes wing to some neighboring mound, from which it will watch the intruder. If wounded, it will scramble into a hole, from which it is difficult to retrieve. If approached gradually, and when at some distance, it will go through a series of curious and ludicrous antics. Its actions suggest those of a young chick which stands for the first time before a brother combatant. It will make a low and profound bow, so that the throat nearly touches the ground; then it stands motionless bolt upright for a moment, with head thrown forward; then come a series of side movements of the head, interspersed with bowing and nodding, with now and then a complete facing to one side or the other. The peculiar combination of long legs, short tail, and round, compact head adds considerably to the grotesqueness of the pantomime.

Many stories have been fabricated in regard to the association of the prairie dog, Owl, and rattlesnake, some of which are unequaled among fairy tales. The whole story is ably told by Dr. Coues in the 'Birds of the Northwest.' After giving a rather exaggerated account of the relations existing between the reptile, mammal, and bird, according to the views of some, he then explains exactly how matters stand in the colony. The following is his account:

"The case is further complicated by the introduction of the rattlesnakes; and no little pure bosh is in type respecting the harmonious and confidential relations imagined to subsist between the trio, which, like the 'happy family' of Barnum, lead Utopian existences. According to the dense bathos of such nursery tales, in this underground Elysium the snakes give their rattles to the puppies to play with, the old dogs cuddle the Owlets, and farm out their own litters to the grave and careful birds; when an Owl and a dog come home, paw-in-wing, they are often mistaken by their respective progeny, the little dogs nosing the Owls in search of the maternal font and the old dogs left to wonder why the baby Owls will not nurse. It is a pity to spoil a good story for the sake of a few facts, but, as the case stands, it would be well for the Society for the Prevention of Cruelty to Animals to take it up. First, as to the reptiles, it may be observed that they are, like other rattlesnakes, dangerous, venomous creatures; they have no business in the burrows, and are after no good when they do enter. They wriggle into the holes, partly because there is no other place for them to crawl into on the bare, flat plain, and partly in search of Owls' eggs, Owlets, and puppies to eat. Next, the Owls themselves are simply attracted to the villages of the prairie dogs as the most convenient places for shelter and nidification, where they find eligible ready-made burrows and are spared the trouble of digging for themselves. Community of interest makes them gregarious to an extent unusual among rapacious birds; while the exigencies of life on the plains cast their lot with the rodents. That the Owls live at ease in the settlement and on familiar terms with their four-footed neighbors is an undoubted fact; but that they inhabit the same burrows or have any intimate domestic relations, is quite another thing. It is no proof that the quadruped and the birds live together that they are often seen to scuttle at each other's heels into the same hole when alarmed; for in such case the two simply seek the nearest shelter, independently of each other. The probability is that young dogs often furnish a meal to the Owls, and that, in return, the latter are often robbed of their eggs; while certainly the young of both and the Owls' eggs are eaten by the snakes." (p. 324.)

The first two weeks in April, earlier or later, according to latitude, is the usual time for this species to begin to deposit its eggs. Capt. Bendire thinks that the period of incubation is about three weeks, and that both birds assist in hatching the eggs. The young Owls make their appearance at the mouth of the hole in the latter part of May.

The eggs are usually five to eight in number, though sets of eleven have been taken. When a nest exists, for the eggs are sometimes placed on the bare earth, it is usually composed of a small quantity of grass or finely broken cow or horse dung, and is situated at the end of the burrow in a somewhat enlarged chamber. The distance from the entrance of course depends on the individual burrows, which vary from 4 to 10 feet in length. A nest which Mr. Ridgway dug out, was situated 8 feet from the entrance and 4 feet below the surface. (U. S. Geol. Explor. of the Fortieth Paral., King, vol. IV, 1877, p. 574.)

DESCRIPTION.

Lower leg more than twice as long as middle toe and about half as long as tail. Above, earthy brown, with buffy spotting and barring. Below, ground color, distinctly buffy, feathers covering base of lower surface of tail unspotted.

Length: 9 to 11 inches (228 to 280$^{\mathrm{mm}}$); extent, 22.50 to 23.50 inches (572 to 597$^{\mathrm{mm}}$); wing, 5.80 to 7.20 inches (147 to 183$^{\mathrm{mm}}$); tail, 3.15 to 3.50 inches (80 to 89$^{\mathrm{mm}}$).

Table showing the results of examinations of 32 stomachs of the Burrowing Owl (Speotyto cunicularia hypogæa).

Locality.	Date.	Poultry or game birds	Other birds.	Mammals.	Miscellaneous.
Fort Buford, N. Dak	Sept. 29, 1887				Grasshoppers.
Wayne County, Nebr.	June —, 1868				62 insects.
Do	do				Lizard, 30 insects.
Pierce County, Nebr.	do				49 locusts, 17 other insects.
Do	do			Prairie dog	46 locusts, 10 other insects.
Do	do				54 locusts, 8 other insects.
Wayne County, Nebr.	July —, 1869			Mouse	65 insects.
Sydney, Cheyenne County, Nebr.	June —, 1875				59 locusts, 3 other insects.
Ogalalla, Keith County, Nebr.	Sept. —, 1876			Mouse	51 locusts, 12 other insects.
Do	do				58 locusts, 4 other insects.
Woodland, Cal	May 24, 1886				4 grasshoppers, 6 other insects.
Pierre, S. Dak	May 21, 1888				Beetle.
Do	May 30, 1888				3 grasshoppers, 7 crickets, 2 beetles.
Reeder, Kans	July —, 1888				Grasshopper, other insects.
Cheyenne, Wyo	Aug. 21, 1888				10 grasshoppers, 45 beetles, other insects.
Do	Aug. 23, 1888				35 grasshoppers, 20 beetles, etc.
Do	do				15 grasshoppers, 6 beetles.
Phœnix, Ariz	May 7, 1889				Insect remains.
Do	May 9, 1889				Scorpion, crickets, beetles.
Albuquerque, N. Mex.	July 16, 1889				20 beetles, 2 crickets, 1 centiped.
Big Butte, Idaho	July 18, 1890				Insects, scorpions.
Del Rio, Tex	Jan. 31, 1890				Small insects.
Verde Valley, Ariz.	Aug. 6, 1884				Grasshoppers.

Table showing the results of examinations of 32 stomachs of the Burrowing Owl (Speotyto cunicularia hypogæa)—Continued.

Locality	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Verde Valley, Ariz.	Aug. 6, 1884				Grasshoppers. other insects.
Wilcox, Ariz.	April 9, 1885				3 small lizards.
Do	May 1, 1885				Lizards, insects.
Camp Verde, Ariz	Aug. 26, 1886				Insects.
Do	do				Empty.
Walker Pass, Cal.	July 2, 1891				5 grasshoppers, 7 molecricket scorpions.
Mohave Desert, Cal	Jan. 15, 1891				Caterpillars and beetles.
Harrison, S. Dak.	Sept. 14, 1891				2 crickets.
Do	Sept. 28, 1891				6 crickets.

SUMMARY.—Of 32 stomachs examined, 3 contained small mammals; 3, lizards; 3, scorpions; 1, a centiped; 30, insects; and 1 was empty.

PYGMY OWL.

Glaucidium gnoma.

The Pygmy Owls, with the exception of the Little Elf Owl, are the smallest of all the North American species. Of these interesting little birds there are two species and two geographical races. The distribution of three is given below, and the other, the Ferruginous Pygmy Owl, will be treated elsewhere under a separate head.

The Pygmy Owl (*Glaucidium gnoma*) inhabits the western United States (except the northwest coast), ranging east to Colorado and New Mexico, and south to the highlands of Mexico.

The California Pygmy Owl (*Glaucidium g. californicum*) inhabits the heavy rainfall area, occurring west of the mountains from British Columbia south to San Francisco.

Hoskin's Pygmy Owl (*Glaucidium g. hoskinsii*) inhabits the southern part of the peninsula of Lower California.

The Pygmy Owl is probably a resident wherever found, except that it may leave the higher mountains and descend to the lower country on the advent of cold weather. Its food consists mainly of insects, though it also destroys small mammals, birds, reptiles, and batrachians. It is surprising what comparatively large mammals and birds it will sometimes seize. Capt. Bendire mentions that a comrade shot one which had seized a large-sized pocket gopher, and, as elsewhere mentioned, he found a full-grown Say's ground squirrel in its nest, a mammal fully twice the weight of the bird.

Dr. J. C. Merrill gives the following relating to its food habits: "One captured February 21 had just struck at a robin and was struggling with it on the ground. It is said to be especially abundant in summer at Modoc Point [20 miles south of Fort Klamath, Oregon], and to feed upon a lizard that is common there; I have also found fragments of field mice in the stomachs. Insects, however, and especially grasshoppers, constitute the greater part of its food when they can be obtained. When the Owl is searching for these the smaller birds pay little attention to it, even if it happens to alight near them." (Auk, vol. v, 1888, p. 146.)

Capt. Bendire mentioned an individual at Fort Klamath which occupied a willow branch over a stream for the purpose, he thought, of watching for frogs, which were common at that spot.

Mr. C. H. Townsend, speaking of this Owl and its food in northern California, says: "It is rather diurnal in its movements and may be seen long before sunset engaged in its search for small birds, upon which it seems to subsist largely, flying closely to the ground along the borders of tule marshes. It doubtless kills marsh wrens and small sparrows, as such birds were often noticed near the hunting grounds of the owl. One Pygmy Owl which I shot had a freshly-killed snowbird (*Junco oregonus*) in its claws." (Proc. U. S. Nat. Mus., vol. x, 1887, p. 204.)

Very little is known of its nesting habits for, besides the nest mentioned by Mr. J. K. Lord, on Vancouver Island, which contained two eggs, in the early part of May, three only have been found. One of these was found by Mr. George H. Ready, on June 8, 1876, near Santa Cruz, Cal., and was situated in a woodpecker's hole in an isolated poplar tree some 75 feet from the ground. It contained three eggs, which were deposited on a mass of small dry twigs and feathers, presumably an old nest of Parkman's wren. This nest was described independently both by Capt. Bendire (Proc. Boston Soc. Nat. Hist., vol. XIX, 1879, p. 132) and Mr. W. C. Cooper (Bull. Nutt. Ornith. Club, vol. IV, 1879, p. 86). Another nest was found at Fort Klamath, Oregon, June 10, 1883, by one of the soldiers, during the absence of Capt. Bendire, who, on his return, June 25, had it examined and found four young from a week to ten days old. As in the previous case, the cavity containing the nest was a deserted woodpecker's hole, about 20 feet from the ground, and in a tree standing within a few feet of the target butt, which was in daily use. The cavity was well filled with feathers and also contained a full-grown chipmunk (*Tamias lateralis*) as food for the young (Bull. Nutt. Ornith. Club, vol. VIII, 1883, p. 242, and Auk, vol. v, 1888, p. 370). The third nest, like the other two, was placed in an old woodpecker's hole, and was found in La Plata County, Colo., by C. F. Morrison, in June, and contained three young (Ornithologist and Oologist, vol. XIII, 1888, p. 115).

This little Owl is diurnal in its habits, feeding and flying about in the bright sunshine, though it is more common in the early dusk and morning. Mr. Henshaw says it is fond of taking its station early in the morning on the top of an old stub, that it may enjoy the warmth of the sun's rays. In most places it is more or less solitary, though in New Mexico Mr. Henshaw found it extremely sociable, and in the fall it was usually met with in companies.

It is tame and unsuspicious and may be decoyed from a considerable distance by imitating its call note, to which it responds at once. It is confined mostly to wooded districts, though occasionally it is found some distance from timber. It hides in the pines or other thick foliage, where it sits upright near the trunk and is practically invisible to the observer.

The flight is not very much like that of other Owls, but resembles that of the Sparrow Hawk to some extent, and is not altogether noiseless. The love notes, according to Capt. Bendire, are somewhat musical, although they resemble to some extent those of the mourning dove.

As a rule the small birds pay little or no attention to the presence of this diminutive Owl, as they do to other species, but the following note from Mr. C. A. Allen shows the rule has exceptions: "There were fighting the Owl one pair of *Tyrannus verticalis*, one pair of Bullock's Orioles, one pair of Bewick's Wrens, three Banded Tits (*Chamœa fasciata*), one pair of *Pipilo oregonus*, one pair of *P. crissalis*, and about twenty Blackbirds (*Scolecophagus cyanocephalus*). The bravest birds of the troop were Bewick's Wren and Bullock's Oriole, which kept darting at the Owl's head as it sat on the ground devouring a young Blackbird." (Bull. Nutt. Ornith. Club, vol. III, p. 193.)

DESCRIPTION.

Size very small; no ear tufts. Lower leg not longer than middle toe, densely feathered; tail more than half as long as wing, tip rounded. Sides of breast brownish, more or less spotted with paler; tail bands always white, the interspaces blackish; top of head speckled or dotted whitish. Below, striped with blackish; back slaty grayish.

Length: 6.50 to 7.50 inches (165 to 190$^{\text{mm}}$); extent, 14.50 to 15.50 inches (368 to 393$^{\text{mm}}$); wing, 3.40 to 4 inches (86 to 101$^{\text{mm}}$); tail, 2.40 to 2.80 inches (60 to 70$^{\text{mm}}$).

Table showing the results of examinations of 6 stomachs of the Pygmy Owl (Glaucidium gnoma).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Ogden, Utah	Oct. 5, 1888		Small bird		
San Pedro, N. Mex	July 6, 1889			White-footed mouse.	
Do	Do				Grasshopper.
Prescott, Ariz	Mar. 21, 1884				Empty.
Fossil Creek, Ariz	Mar. 29, 1886				Lizards.
Mogollon Mts., Ariz.	July 26, 1887				Empty.

SUMMARY.—Of 6 stomachs examined, 1 contained a small bird; 1, a mouse; 1, lizards; 1, an insect, and 2 were empty.

FERRUGINOUS PYGMY OWL.

Glaucidium phalænoides.

The Ferruginous Pygmy Owl inhabits the whole of tropical America, except the West Indies, ranging north to southern Texas and Arizona. This beautiful little Owl was added to our fauna in 1872, by Capt. Bendire, who captured several specimens in the dense mesquit thickets bordering Rillito Creek, in the vicinity of Tucson, Ariz. As the first specimen was taken January 24, it is evidently a resident wherever found.*

Very little has been written on the subject of the food of this species, but undoubtedly it is of much the same quality as that of other members of the genus. A specimen captured by Dr. E. A. Mearns at Casa Grande, Ariz., May 10, 1885, contained the remains of a lizard. In South America it is reported as sometimes feeding on young chickens.

Little is known of its nesting habits, but they are undoubtedly similar to those of the Pygmy Owl. Mr. George B. Sennett gives the first description of the eggs in the Auk (vol. VI, 1889, p. 70). The nest was in a hollow tree and contained but a single egg, which was very close to the size of that of the elf owl. In 1872 Captain Bendire found two fledglings in a hollow mesquit tree in southern Arizona, which at the time were thought to be young Elf Owls, but at present he is inclined to refer them to this species, as the first-mentioned Owl almost universally breeds in the hollows of the giant cactus.

Like the other Pygmy Owls, this species is diurnal in its habits, flying about and capturing its prey in the bright sunlight.

"His note was a loud *cuck* repeated, several times as rapidly as twice each second. At each utterance the bird jerked his tail and threw back his head. Occasionally a low *chuck*, audible for only a short distance, replaced the usual call."—(F. Stephens in Bull. Nutt. Ornith. Club, vol. VIII, 1883, p. 27.)

DESCRIPTION.

Similar to the Pygmy Owl in size and general character. Sides of breast brown or rufous, without traces of lighter markings; tail bands varying from white to rufous, the interspaces varying from grayish to blackish; top of head narrowly streaked with whitish or pale rusty.

Length: 6.50 to 7 inches (165 to 178^{mm}); extent, 14.50 to 15.50 inches (368 to 393^{mm}); wing, 3.50 to 4.60 inches (89 to 116^{mm}); tail, 2.20 to 3.50 inches (55 to 89^{mm}).

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* The writer found this species quite common at New River, thirty-five miles NNW. of Phœnix, Ariz., in June, 1892. Two specimens were secured and several others observed among the mesquit and other thick shrubbery scattered through the groves of giant cactus.

ELF OWL.

Micropallas whitneyi.

This little Owl, the smallest known species in North America, was first discovered by Dr. J. G. Cooper, at Fort Mohave, Ariz., on April 26, 1861, and described by him in the Proceedings of the California Academy of Natural Sciences, 1861, p. 118. At present it is known to inhabit the southwestern United States, ranging from central Arizona (Prescott), southeastern California, and Lower California, southward to southern Mexico. In parts of Arizona it is very common, for Mr. W. E. D. Scott says: "On one occasion while collecting with Mr. F. Stephens, near Fuller's ranch [near Tucson], about the last of May, 1883, we secured, with no particular exertion, over twenty of these birds and a dozen or more nests of eggs in about six hours." (Auk, vol. III, 1886, p. 424.)

It almost invariably breeds in deserted woodpeckers' holes, in the giant cactuses, though a few nests have been found in hollow mesquit or other trees. The eggs are from two to five in number, three being the most common, and the extremes rare. Fresh sets are found from the first week in May to the third week in June, which latter date is late for Owls generally to breed. Except during the breeding season when the females are found in the nest holes, the species lives in the thick brush and thickets through the day. Evidence goes to show that during the breeding season the males are more or less gregarious, keeping in willow copses or other thickets.

The species is nocturnal in its habits, not emerging from its retreat until twilight is well advanced, when it may be seen flying about in the fading light. It is said to have several notes which are heard more often in the early evening and again about daybreak.

The following from Mr. F. Stephens, which was published by Mr. Brewster, is interesting in adding to our knowledge of the habits of this comparatively little known bird: "I was walking past an elder bush in a thicket when a small bird started out. Thinking it had flown from its nest I stopped and began examining the bush, when I discovered a Whitney's Owl sitting on a branch with its side toward me and one wing held up, shield-fashion, before its face. I could just see its eyes over the wing, and had it kept them shut I might have overlooked it, as they first attracted my attention. It had drawn itself into the smallest possible compass so that its head formed the widest part of its outline. I moved around a little to get a better chance to shoot, as the brush was very thick, but whichever way I went the wing was always interposed, and when I retreated far enough for a fair shot I could not tell the bird from the surrounding bunches of leaves. At length, losing patience, I fired at random and it fell. Upon going to pick it up I was surprised to find another, which I had not seen before, but which must have been struck by a stray shot." (Bull. Nutt. Ornith. Club, vol. VIII, p. 28.)

Little or nothing is known of the food of this species, though probably it feeds on insects and the smaller rodents.

DESCRIPTION.

Smallest Owl inhabiting the United States. Lower leg longer than middle toe, scantily haired; tail less than half as long as wing, straight across the end. No ear tufts. Above, grayish or brownish, finely mottled with darker and indistinctly speckled with pale rusty; tail brownish, covered by five or six narrow, usually interrupted, bands of pale brown or rusty; eyebrows, space in front of eyes and under chin, white. Below white, marked with longitudinal blotches of brown or rusty.

Length: 5.50 to 6.25 inches (140 to 159$^{\text{mm}}$); extent, 14.25 to 15.25 inches (362 to 387$^{\text{mm}}$); wing, 4 to 4.40 inches (101 to 111$^{\text{mm}}$); tail, 1.90 to 2.30 inches (47 to 58$^{\text{mm}}$).

Table showing the results of examinations of three stomachs of the Elf Owl (Micropallas whitneyi).

Locality.	Date.	Poultry or game birds.	Other birds.	Mammals.	Miscellaneous.
Tanque Verde, Ariz	Mch. 30,1890			Small mammal	20 beetles.
Fort Lowell, Ariz	Apr. 20,1890				19 beetles, grasshoppers.
Fort Huachuca, Ariz	May 7,1892				Beetle remains.

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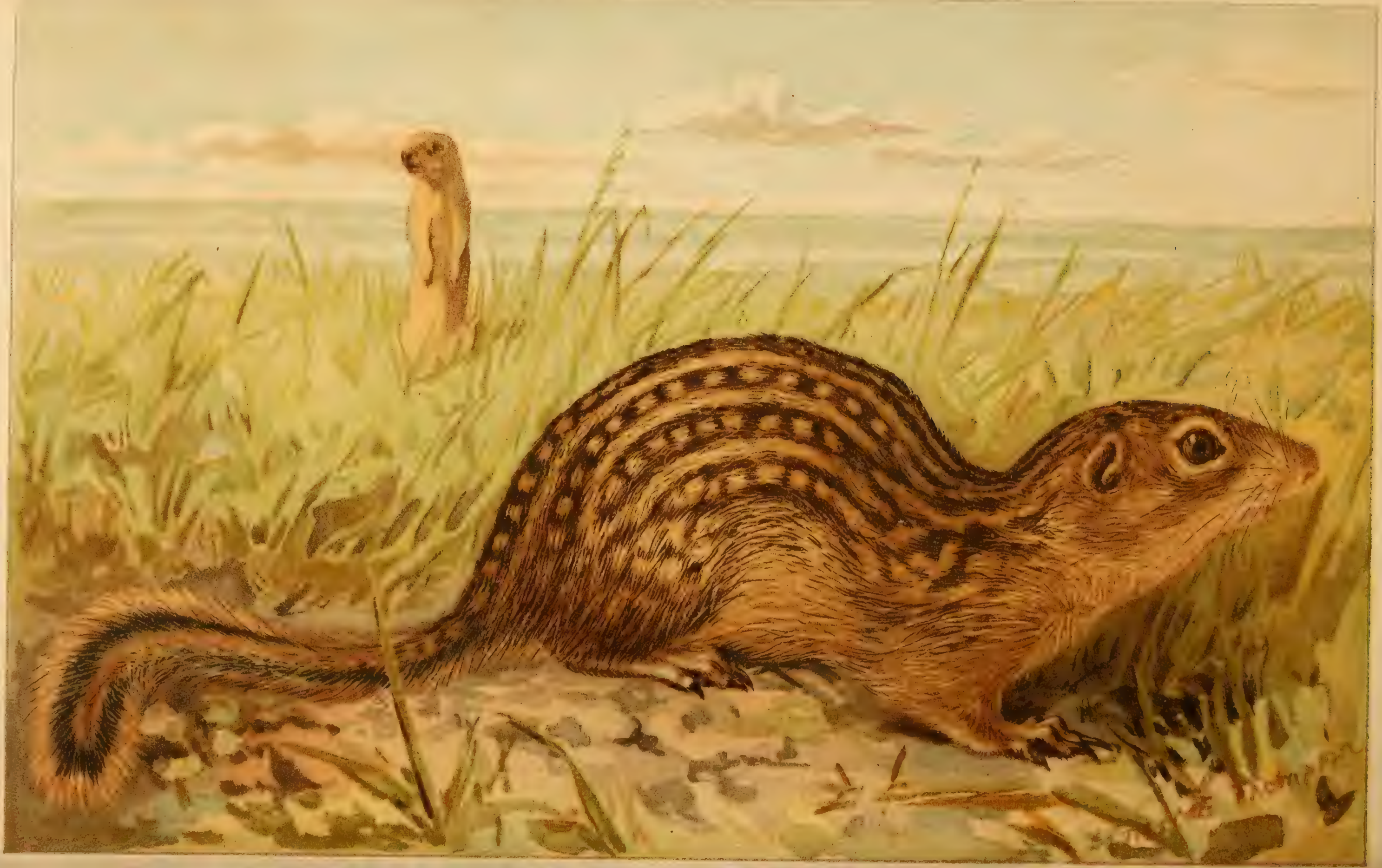
U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY
BULLETIN No. 4

THE PRAIRIE GROUND SQUIRRELS OR SPERMOPHILES OF THE MISSISSIPPI VALLEY

PREPARED UNDER THE DIRECTION OF
DR. C. HART MERRIAM, CHIEF OF DIVISION
BY
VERNON BAILEY
CHIEF FIELD AGENT

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1893



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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Ornithology and Mammalogy,
Washington, D. C., August 17, 1893.

Sir: I have the honor to transmit herewith a report on the Ground Squirrels or Spermophiles of the Mississippi Valley, for publication as Bulletin No. 4 of this Division.

This report has been prepared by Mr. Vernon Bailey, chief field agent of the Division. Since it is intended as an economic bulletin it is devoted chiefly to the food habits and distribution of the several species, technical matter being omitted.

The accompanying illustrations were drawn by Mr. Ernest E. Thompson.

Respectfully,

C. Hart Merriam,
Chief of Division.

Hon. J. Sterling Morton,
Secretary of Agriculture.

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THE PRAIRIE GROUND SQUIRRELS OR SPERMOPHILES OF THE MISSISSIPPI VALLEY.

INTRODUCTION.

The destructive animals that form the subject of the present bulletin belong to the genus *Spermophilus*, and are commonly known as spermophiles. The name is derived from the Greek words σπέρμα, seed, and φιλεῖν, to love, in allusion to the fact that seeds form a large proportion of the food of the various species. In the Old World the spermophiles are known as sousliks, while in America they are popularly called gophers or ground squirrels. The term 'gopher,' however, belongs properly to a very different group of animals, to which it should be restricted, namely the pocket gophers which have external cheek pouches, and resemble the moles in living underground and throwing up little mounds along the courses of their subterranean tunnels. 'Ground Squirrel' is a less objectionable name, because these animals really are ground squirrels; the term is however commonly applied to the chipmunks belonging to the related genus *Tamias;* hence the name spermophile is here used in preference to either of the others.

The object of the present bulletin is to describe the haunts and habits of the five species inhabiting the Mississippi Valley region, and to summarize the remedies that have been used with greatest success in holding their numbers in check. *Spermophilus* is a large genus, and is found throughout the greater portion of the north temperate region of both hemispheres from eastern Europe across northern Asia, and over the western two-thirds of North America. The total number of species and subspecies of spermophiles inhabiting the United States is about thirty-five, and most of them are restricted to the arid and subarid region west of the Rocky Mountains. Throughout their range, wherever the land is under cultivation, they are among the most destructive of mammals, feeding on grain, fruit, and garden vegetables to such an extent that the annual losses from their depredations must be counted in hundreds of thousands of dollars. Several States have paid large sums in bounties for their destruction, without materially reducing their numbers.

The region here considered comprises the Mississippi Valley in a very broad sense, including the fertile prairies of the valley proper, and also the Great Plains as far west as the foothills of the Rocky Mountains. In a north and south direction it embraces the vast area stretching from the Mexican boundary and the Gulf of Mexico north to the plains of the Saskatchewan River. It comprises the largest and by far the most important continuous stretch of agricultural land on the continent, and the greater part of it is now under high cultivation. Five very distinct species of spermophiles inhabit this region, four of which are restricted to it, namely: Richardson's Spermophile (*Spermophilus richardsoni*), Franklin's Spermophile (*Spermophilus franklini*), the Striped Spermophile (*Spermophilus tridecemlineatus*), and Kennicott's Spermophile (*Spermophilus spilosoma obsoletus*); the fifth, the Mexican Spermophile (*Spermophilus mexicanus*), ranges southward over the table-land of Mexico as far as the Valley of Mexico. Only two species (*S. franklini* and *S. tridecemlineatus*) range east of the Mississippi River, and these find their extreme eastern limits respectively in western Indiana and eastern Michigan.

On account of the immense damage done to crops these animals have been the subject of investigation at some of the agricultural colleges and experiment stations in the West, and several bulletins have been issued containing notes on their food habits or giving directions for their destruction.

In 1878 Prof. E.W. Hilgard, of the University of California, published a bulletin on the destruction of ground squirrels by the use of bisulphide of carbon.* This method has proved by far the most successful of any thus far put in practice, and has been largely adopted with gratifying success. (See pp. 29–30.)

Mr. E. J. Wickson in his work on California Fruits devotes a paragraph to methods of destroying ground squirrels in orchards.† He recommends three means of extermination: (1) Poisoned wheat; (2) bisulphide of carbon, and (3) 'smokers.' The latter term includes the various devices for burning sulphur or damp straw and forcing the fumes into the burrows, thereby suffocating the inmates.

In August, 1889, Prof. C. P. Gillette published the results of an examination of the stomachs of twenty-two specimens of the Striped Spermophile (*Spermophilus tridecemlineatus*) in a paper entitled 'Food Habits of the Striped Prairie Squirrel.'‡ He showed that this species is not an unmixed evil, for besides large quantities of grain, it eats numbers of grasshoppers, wireworms, and other noxious insects. He concludes that a large proportion of its food is made up of insects, which seem to consist almost exclusively of injurious species, chiefly cutworms, webworms, and grasshoppers, and adds: "The squirrels would be a most valuable adjunct to any cornfield after planting if some method could be devised to prevent them from taking the corn."

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*Bulletin of the University of California, No. 32, April, 1878.

†E. J. Wickson: The California Fruits and How to Grow Them. San Francisco, 1889, p. 554.

‡Bulletin No. 6, Iowa Agricultural Experiment Station, August, 1889, pp. 240–244.

Continuing this same line of investigation, Mr. J. M. Aldrich, of the South Dakota Agricultural College and Experiment Station, published a paper on the Food Habits of the Striped Gopher, in March, 1892.* Mr. Aldrich, after referring to Prof. Gillette's previous examinations, also gives the results of an examination of fifteen stomachs made by himself, and says: "As far as our observations go they did not give the gopher as favorable showing as Prof. Gillette's did." (See pp. 40–42.)

One of the bulletins of the Oregon Experiment Station contains an important paper by Prof. F. L. Washburn on 'Gophers and Moles.'† It is devoted mainly to methods of destroying the pocket gopher (*Thomomys*) and mole (*Scapanus*), and gives several illustrations of traps said to be specially adapted for the capture of these animals. A few suggestions for destroying the 'Digger Squirrel'‡ are added, and bisulphide of carbon and strychnine recommended for this purpose.

Recently Prof. F. J. Niswander, entomologist of the Wyoming Experiment Station, has published a bulletin on 'Ground Squirrels.'§ After giving evidence from several correspondents as to the injuries caused by spermophiles in the vicinity of the station at Laramie, Wyo., he recommends the use of bisulphide of carbon for destroying the animals. Unfortunately the author has mistaken the southern form of Richardson's Spermophile (*Spermophilus richardsoni elegans*), found in this locality, for Franklin's (*S. franklini*), which latter is a widely different animal and one that does not reach Wyoming at all. This bulletin contains two full-length illustrations, one of the California Ground Squirrel (*Spermophilus beecheyi*), the other of the southern Rocky Mountain Spermophile (*Spermophilus grammurus*), neither of which species occurs in Wyoming.

PLAN OF THE INVESTIGATIONS.

The work of bringing together the facts upon which the present bulletin is based may be arranged under three heads, namely, correspondence, field work, and laboratory work.

Correspondence.—In 1886 a circular was widely distributed in which information was asked for respecting the habits, ranges, and distribution of pocket gophers and spermophiles (Circular No. 3, Division of Ornithology and Mammalogy).

In response hundreds of letters were received, and while many of them contained matter of little value or statements that were evidently incorrect, the greater number were simple statements of fact that added much new and original information to the previous knowledge of the habits and distribution of North American mammals. A marked interest in the subject was awakened throughout the country, and many naturalists and others in position to observe the habits of mammals contributed notes of especial interest.

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* South Dakota Agricultural College and Experiment Station, Bulletin No. 30, March, 1892, pp. 8–11.

† Oregon Agricultural Experiment Station, Bulletin No. 25, April, 1893, pp. 14–23, pl. III; 10 figs. in text.

‡ The species which occurs in Oregon is not *Spermophilus beecheyi*, as here given, but the closely related form *douglasii*.

§ Wyoming Experiment Station Bulletin, No. 12, April, 1893, pp. 25–35. Figs. 1–3.

In July, 1888, and again in January, 1889, copies of the following circular were distributed throughout the Mississippi Valley, asking for specific information respecting the Striped Spermophile (*Spermophilus tridecemlineatus*), Franklin's Spermophile (*Spermophilus franklini*), and the pocket gopher (*Geomys bursarius*) with a view to procuring data from which to map accurately the range of the several species and at the same time to gain as much information as possible concerning their food and all habits relating directly or indirectly to agriculture.

[CIRCULAR ON GOPHERS, NO. 9.]

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF ECONOMIC ORNITHOLOGY AND MAMMALOGY,
Washington, D. C., ——, 188—.

Mr. —— ——,
—— ——:

DEAR SIR: The Department of Agriculture wishes to secure enough information concerning the range of the three species of Gophers which inhabit the Mississippi Valley to enable it to map with precision the exact area occupied by each. Any information relating to the subject, though not covered by the following questions, will be thankfully received.

* * * * * * *

I. Is the Striped Gopher or Ground Squirrel (*Spermophilus tridecemlineatus*) present in your neighborhood?

If so, is it destructive to farm crops?
Has it any beneficial traits?

II. Is the Gray Gopher or Ground Squirrel (*Spermophilus franklini*) present in your neighborhood?

If so, is it destructive to farm crops?
Has it any beneficial traits?

* * * * * * *

[Washington, D. C., July 30, 1888.]

The replies to this circular made it possible to map the range of these animals with greater accuracy and detail than otherwise could have been accomplished. Each locality from which specimens were examined was marked on a large map of the United States devoted to the species. These maps formed the basis for the accompanying distribution maps. Between the positive localities a multitude of reports of occurrence cover the ground, save in certain definite areas where for some reason the species does not occur. In determining the extreme limits of the range of each species, the localities from which it has been reported are of material assistance as indicating areas from which specimens should be obtained in order to settle beyond question the identity of the species. All doubtful records have been discarded.

Many of the replies to Circular 9, and to other special letters of inquiry, contained detailed accounts of injury to crops, interesting notes on the habits of the spermophiles, and various means employed for their destruction. A few extracts from these letters are given under each species and present the case as seen by those most deeply interested. Some of the reports may be prejudiced, but in many the good as well as the evil traits of the animals are recognized.

Field work.—Competent men employed by the Division as special field agents have been sent to parts of the country from which complaints had been received concerning the ravages of spermophiles. In some cases the reports of damage to crops were found to be exaggerated or attributed to the wrong species, and such errors were corrected by means of these field investigations. Specimens of the animals were collected for identification and comparison, their abundance was carefully estimated, their geographic range, details of distribution, breeding habits, food habits at different seasons of the year, and the various methods employed for their destruction were carefully studied, and a large number of stomachs was collected and preserved in alcohol for subsequent examination in the laboratory.

Nor were the investigations limited to spermophiles and pocket gophers, for some attention was given to the habits of their natural enemies, particularly the birds and mammals that prey upon them. In examining the stomachs of hawks and owls remains of spermophiles were frequently found, and in some instances the birds were seen in the act of catching or eating them. Badgers were found to spend considerable time in digging ground squirrels and pocket gophers out of their holes, and to be of no small importance in holding in check the numbers that otherwise would add their increase to present hordes. Other animals also were found to feed upon them, as mentioned in detail later.

Laboratory work.—Though the contents of many stomachs were examined in the field such examinations were made mainly for the purpose of learning the sort of food selected by the spermophiles so that their habits might be more fully understood. The stomachs of most of the specimens were preserved in alcohol, and each was labeled with a tag of parchment paper bearing a number in carbon ink. A corresponding number was entered on a schedule and followed by the name and sex of the animal, place where taken, date, hour at which killed, and such notes as might help in understanding any peculiarity of food found in the stomach. Such notes were usually a brief statement of the animal's surroundings when killed; as, 'near wheat field,' 'in meadow,' 'on open prairie,' or 'on edge of cornfield.' These preserved stomachs, together with the accompanying schedules, were forwarded to the Department for critical examination. Each stomach was cut open, the contents spread out on a plate, and enough water added to wash out the fine sediment. Among the coarser materials were found hairs, feathers, the outer coats of grains, shells of seeds, the legs, wings, heads, and jaws of grasshoppers, beetles, and various other insects, the skins of caterpillars, and a great variety of things, as shown in the tables prepared from the examinations.

Unlike the contents of many birds' gizzards, everything had been chewed, not swallowed whole; very few complete insects were found in condition to be identified although it was often possible to recognize the genus but rarely the species. Grains and seeds could be identified more frequently. Softer materials, as foliage and flowers, could be easily distinguished as such, but the species could seldom be told. As far as possible the different materials from each stomach were separated and the relative proportions carefully estimated. The difficulty in perfectly separating the different kinds of food prevented any attempt at weighing or measuring to obtain precise proportions. Hence the percentages given are only approximate.

In examining the contents of cheek pouches much more definite results were obtained. The seeds and grains carried in them were usually in perfect condition and easily identified by comparison with seeds in the laboratory collection.

In the preparation of this bulletin the mass of original notes contributed by observers has been supplemented by frequent references to the literature of the subject, and numerous extracts have been made from reliable sources. The results of the investigations of several experiment stations have been freely used. Part of the chapter on methods of destruction, and some of the notes on *Spermophilus tridecemlineatus*, *S. franklini*, and *S. richardsoni*, together with the plates illustrating these species, have already appeared in a paper by the author in the Annual Report of the U. S. Department of Agriculture for 1892, pp. 186–189.

It would be impracticable, even were it desirable, to mention the large number of correspondents who have contributed data. Some have sent in specimens, others valuable notes on the range or habits of the several species, while the answers received to letters of inquiry on the subjects of distribution and bounties alone number several hundred. Much information on the distribution of these spermophiles is still needed from localities near the limits of their ranges. But without the assistance so freely given it would have been almost impossible to determine precisely the areas inhabited by the species, and acknowledgments are due to all who have aided the work.

NATURAL ENEMIES OF SPERMOPHILES.

The most important natural enemies of spermophiles are the diurnal birds of prey. Day after day the marsh hawk (*Circus hudsonius*) may be seen gliding over fields and prairies, occasionally making a sudden turn and diving to the ground to pick up a mouse or spermophile. According to Dr. A. K. Fisher, "Its food consists largely of small rodents, such as meadow mice, half-grown squirrels, rabbits, and spermophiles or ground squirrels. In fact, so extensively does it feed on the last-named animals that the writer rarely has examined a stomach from the West which did not contain their remains."* The heavier hawks, as the red-tail and Swainson's hawk, inhabiting the prairie country also subsist largely upon them.

Even the ferruginous roughleg (*Archibuteo ferrugineus*), one of the largest of our hawks, is not above making a meal of one when an opportunity offers. I once surprised one of these hawks in a hot pursuit of a Striped Spermophile, which, however, succeeded by active dodging in reaching a hole in time to escape. "This bird is known as the 'California squirrel hawk' in some localities, but it is not to be inferred that they often capture the agile arboreal *Sciuri*. The name is gained from their feeding extensively, in California, upon the 'ground squirrels' (*Spermophilus beecheyi*), which abound in many parts of that State. The hawks are almost always, too, observed in the vicinity of the settlements of the *Spermophili*, standing on the ground where there are no trees, or flying low over the surface, in either case on the alert to seize any unlucky animal that may venture too far from home. They are also said to perch in wait at the entrance of the burrows, ready to clutch the first animal that shows his nose above ground."†

Ordinarily owls and spermophiles do not meet, as each sleeps during the hours in which the other is active. The diurnal snowy owl and hawk owl may find other spermophiles far to the north, but in winter, when they come south over the United States, these animals are in their winter dens. The little burrowing owl (*Speotyto c. hypogœa*), though active both day and night, feeds principally upon grasshoppers and beetles; but once I shot one as it carried a nearly full-grown Striped Spermophile in its claws. It is probable that it destroys many of the smaller species of spermophiles or their young.

Capt. Chas. E. Bendire gives the following account of an experiment showing that the burrowing owl will kill and eat adult spermophiles: "In this vicinity [Walla Walla, Wash.] these owls seem to live to a great extent on that pest of the farmer, Townsend's Ground Squirrel (*Spermophilus richardsoni townsendi* Allen), which would be much more destructive if not kept down by these owls. In order to satisfy myself that they were actually able to kill adult squirrels, I trapped several and placed them alive (they had been caught in a wire trap and were not at all injured) in a room with a pair of these owls. As soon as noticed by the latter, one of them would fasten his talons into the squirrel's back and, with a few well-directed strokes of its beak, break the vertebræ of the neck and eat the head of the squirrel, often before the latter was quite dead; yet the remainder of the body was usually left and devoured later. I was surprised to see how easily they killed these squirrels, which made scarcely any resistance." (Ornithologist and Oölogist, Vol. VI, 1881, pp. 41–42.)

---

*Bulletin No. 3, The Hawks and Owls of the United States, 1893, p. 27.

†Coues, Birds of the Northwest, 1874, p. 366.

No less than 16 of the 73 species and subspecies of hawks and owls found in the United States and British America are known to prey on the various members of the genus *Spermophilus*. The following species have been reported to feed on these animals, and more careful observations will undoubtedly increase the list:

HAWKS.

Circus hudsonius.
Accipiter cooperi.
Parabuteo u. harrisi.
Buteo b. krideri.
Buteo b. calurus.
Buteo swainsoni.
Archibuteo ferrugineus.
Aquila chrysaëtos.
Haliæetus leucocephalus.
Falco mexicanus.

OWLS.

Strix pratincola.
Bubo v. subarcticus.
Nyctea nyctea.
Surnia ulula caparoch.
Speotyto c. hypogæa.
Glaucidium g. californicum.

In our investigations of the food of hawks and owls the remains of spermophiles were actually found in the stomachs of 22 specimens representing 7 species of these birds. The total number of stomachs of these species examined was 981. This proportion (about 2¼ per cent) does not represent the true percentage of spermophiles in the bird's food inasmuch as a very large number of the stomachs were obtained from birds killed in the eastern United States where spermophiles do not occur. Thus, in a total of 562 stomachs of the redtail (*Buteo borealis*) and its subspecies, 477 were taken in States east of the range of *Spermophilus;* and of 127 stomachs of the great horned owl (*Bubo virginianus*) only 53 were taken within the range of this genus, and of these 11 were empty. If, on the other hand, all empty stomachs and all those taken outside the range of *Spermophilus* are discarded (a total of 799), the percentage containing spermophiles is increased from 2¼ to 12; while 23 per cent of the marsh hawks examined, 25 per cent of the prairie falcons, and 40 per cent of Harris' hawks were found to have fed on these animals, as shown in detail in the following table:

*Table showing stomachs of Hawks and Owls which contained Spermophiles.**

Species.	Locality.	Date.	Spermophiles.	Total number of stomachs examined.†
Marsh hawk	Travare, S. Dak	July 5, 1887	Spermophilus 13-lineatus	
Do	Pembina, N. Dak	July 30, 1887	do	
Do	do	do	do	
Do	do	do	do	
Do	Devils Lake, N. Dak	Aug. 11, 1887	do	
Do	Cheyenne, Wyo	Aug. 21, 1888	do	
Do	Birch Creek, Idaho	Aug. 4, 1890	Spermophilus mollis	30
Cooper's hawk	Three Rivers, Cal	July 28, 1891	Spermophilus beecheyi	22
Harris' hawk	Phœnix, Ariz	May 13, 1889	Spermophilus tereticaudus.	
Do	do	do	Spermophilus	5
Red-tailed hawk	Devils Lake, N. Dak	Aug. 11, 1887	Spermophilus franklini and S. 13-lineatus.	
Do	Vermillion, S. Dak	Apr. 9, 1890	Spermophilus 13-lineatus	
Do	San Francisco Mt., Ariz.	Aug. 3, 1889	Spermophilus lateralis	
Do	do	Aug. 26, 1889	do	
Do	do	Sept. 16, 1889	do	
Do	do	June 12, 1887	do	
Do	Marfa, Texas	Jan. 19, 1890	Spermophilus grammurus.	60
Swainson's hawk	Birch Creek, Idaha	Aug. 4, 1890	Spermophilus mollis	15
Prairie falcon	Cheyenne, Wyo	Aug. 3, 1888	Spermophilus 13-lineatus	
Do	Laramie Mts., Wyo	Aug. 4, 1888	Spermophilus richardsoni elegans.	8
Horned owl	Camp Verde, Ariz	Oct. 28, 1885	Spermophilus harrisi	
Do	do	Aug. 28, 1886	Spermophilus grammurus.	42

*Compiled from tables in Bulletin No. 3, The Hawks and Owls of the United States, 1893.

†Only those stomachs which contained food and which were taken within the region inhabited by spermophiles are included.

Among mammals, the spermophiles' greatest enemy is undoubtedly the badger which makes a regular business of finding and digging out the holes in which they live, and devouring the occupants. I have found their remains in a badger's stomach after the spermophiles had hibernated, so that none could be caught in traps. In speaking of the habits of this animal, Dr. Coues says:

"The badger, too slow of foot to capture the nimble rodents which form its principal food, perpetually seeks them in their own retreats; and it is the work of a few minutes for this vigorous miner to so far enlarge their burrows that it can enter and reach the deepest recesses. In places where the badgers and spermophiles most abound, the continual excavation of the soil by these animals fairly undermines and honeycombs the ground." (Fur-Bearing Animals, 1877, p. 281.) Though the badger indulges in quite a varied diet spermophiles are his main dependence, and where they are abundant badgers are usually abundant also. As the country becomes settled, badgers are killed whenever opportunity offers, either for sport or because they have been known to trouble the poultry yard. As a result the spermophiles increase more rapidly unless other means be employed for their destruction.

Foxes, coyotes, and wild cats do not lose an opportunity to dine upon any small mammal that comes in their way, though as the greater part of their hunting is carried on at night fewer spermophiles than nocturnal animals fall to their prey. Doubtless a few of the smaller species are captured by skunks, though a greater part of the food of the skunk consists of smaller game, insects, and fruit. The long-tailed weasel (*Putorius longicauda*) is one of their most deadly enemies. It readily enters the burrows and kills the occupants without the slightest inconvenience. On the prairies of the Dakotas, Nebraska, and Wyoming they may frequently be seen running quickly from one hole to another, and as is usual with weasels, they probably kill far more than they can eat, merely for the pleasure of killing. These weasels always seem to be rather scarce, else no spermophiles would remain alive.

There is no doubt that the larger snakes destroy great numbers, especially of the young, though definite information on the subject is scarce. I have frequently found large bull snakes (*Pituophis*) crawling in or out of their holes, and have found pocket gophers and other animals of the size of small spermophiles in the snakes.

Thus it may be seen that without the aid of man there are abundant provisions for regulating the abundance of these animals and preventing their too rapid increase. The great danger is that in some of his blind efforts to rearrange matters in a more satisfactory manner man will destroy his friends instead of his enemies.

BOUNTIES.

The damage done by spermophiles is so great that the expedient of offering bounties for their destruction has been tried in several States where these pests are most abundant. Iowa, North and South Dakota, Minnesota, Montana, and more recently Washington, have all expended large amounts in this way.

In 1888 and 1889 an attempt was made to ascertain the amounts actually paid for the destruction of spermophiles and pocket gophers in the Dakotas, Iowa, and Minnesota, but owing to the difficulty in obtaining accurate returns, the investigation was abandoned. With the exception of Minnesota there were no State laws, the bounties being paid by the counties, and this necessitated obtaining returns from the auditor of each county. A more serious difficulty was the fact that these returns included bounties on several species of mammals, and sometimes birds, and gave merely the total amount expended, making it almost impossible in most cases to ascertain the proportion paid for the destruction of each species. In the following tables given under each State returns are included only from counties which it is reasonably certain paid some part of the bounty on spermophiles. In some cases the county records were found to be very incomplete, and in others no replies were received to the letters of inquiry sent out, so that only a part of the counties which have actually paid bounties are included. For these reasons the tables are necessarily very incomplete and are only included for the purpose of giving a general idea of the large amounts expended for the destruction of ground squirrels.

Dakota.—Bounties in the Territory of Dakota were paid by the counties, there being no Territorial bounty. The following resolutions passed by the board of county commissioners of Rolette County may be taken as an example of the law under which the bounties were paid: "That a bounty of 3 cents each be paid for the killing of each gopher within the following described territory in the county of Rolette. * * * The tails of all gophers caught to be preserved and taken before one of the officers hereinafter mentioned, and an affidavit made and subscribed before such officers, setting forth that the gophers were killed within the boundaries of said territory, and since the passage of this resolution, and the several officers hereinafter designated * * * are instructed to carefully examine the persons making such affidavit as to the truthfulness of their statement set forth therein, and such officers to preserve the tails of the gophers so caught and return them together with the affidavits taken by them."

Under the above resolution county warrants were issued to the amount of $1,940.85 for 64,695 gopher tails produced and verified by affidavits.

The following table shows that ten counties now included in North Dakota expended $37,248.16 for the destruction of spermophiles, while three counties now in the State of South Dakota paid $2,247.86, of which $74.63 was spent for pocket gophers.

Table showing bounties paid on Spermophiles by Counties of North Dakota.

County.	Rate.	Date.	Total amount paid on spermophiles and other animals.	Total bounty paid by county.	Remarks.
	Cents.				
Barnes	3	1887 1888	*$9,000.00 6,000.00	$15,000.00	
Benson	2 3	1886 1887	300.00 1,200.00	1,500.00	July 7 to Aug. 6. Apr. 11 to June 11.
Bottineau	3 3	1886 1887	400.00 1,100.00	1,500.00	May 1 to July 1.
Cavalier	†20	1887 1888 1889	1,800.00 700.00 3,500.00	6,000.00	
Griggs	3	1887	5,200.60	5,200.60	Bounty withdrawn.
La Moure					"County has expended thousands of dollars to destroy the gray gopher."—George R. Fralick, La Moure, N. Dak., Aug., 1888.
Nelson	4 3	1886 1887	177.32 4,363.25	4,540.57	July to September. April to July.
Ramsey	3	1887	774.05	774.05	May and June. No bounty in 1888.
Rolette	4	1887	1,940.85	1,940.85	June 8 to Sept. 6; gray gophers predominated about 4 to 1.
Towner	2½ 3	1888 1889	396.21 395.88	792.09	
Total				37,248.16	

* Approximate. †Per dozen.

Table showing bounties paid on Spermophiles by Counties of South Dakota.

County.	Rate.	Date.	Total amount paid on spermophiles and other animals.	Total bounty paid by county.	Remarks.
	Cents.				
Edmunds	3	1888	$1,800.00	$1,800.00	3 per cent pocket gophers.
Hyde	2	1887	412.00	412.00	5 per cent pocket gophers.
Potter	1	1886	35.86	35.86	
Total				2,247.86	Includes $74.63 for pocket gophers.

Iowa.—Sections 1487 and 1488 of the Code of Iowa (1873) provided for the payment of bounties on wolves and other large animals but not on gophers or spermophiles. Elsewhere the power was conferred on the board of supervisors at any regular meeting "To determine what bounties, in addition to those already provided by law, if any, shall be offered and paid by their county on the scalps of such wild animals taken and killed within their county as they may deem it expedient to exterminate. But no such bounty shall exceed five dollars." (Code of Iowa, 1873, Title N, Chap. 2, Sec. 303.)

Under this law eight counties expended $14,031.96 for the destruction of Gray and Striped Spermophiles previous to the year 1890, as shown in the following table:

Table showing bounties paid on Spermophiles by Counties of Iowa.

County.	Rate.	Date.	Total amount paid on spermophiles and other animals.	Total bounty paid by county.	Remarks.
Boone	5 cents, striped	1888	$2,000.00	$2,000.00	
Cerro Gordo	3 cents	1864–1865	954.45	954.45	June 9, 1864, to Oct. 18, 1865.
Franklin	2 cents, striped 3 cents, gray	1885 1887 1888 1889	†750.00 965.00 1,195.00 1,546.00	4,456.00	75 per cent for striped and gray in 1889.
Hancock		1888	1,150.00	1,150.00	
Humboldt	3 cents, striped 5 cents, gray	1888 1889	2,198.01 2,400.00	4,598.01	June 1 to July 1, 1888.
Ida	10 cents, gray	1878–1882	*700.00	700.00	Bounty in force 1878–1882.
O'Brien	5 cents, striped 8 cents, gray	1874?			
Plymouth	2½ cents, striped 5 cents, gray	1875–1876	†560.00	560.00	
Total				14,418.46	Includes $386.50 for other species.

* Amount paid in one month. † Approximate.

Kansas.—No attempt was made to ascertain the amount expended in Kansas, but it is probable that bounties were offered in several counties. Mr. J. S. Betzer, of Copeland, Kans., reported that the county of Thomas paid a bounty of 3 cents per scalp during the spring of 1890. The total amount expended was more than $5,000, which, however, included a small sum paid for bounties on wolves.

Minnesota.—In the spring of 1887 the State of Minnesota passed the following bounty laws:

AN ACT TO PROVIDE BOUNTIES FOR THE DESTRUCTION OF GOPHERS AND BLACKBIRDS.

Be it enacted by the Legislature of the State of Minnesota—

SECTION 1. That gophers and blackbirds are declared public nuisances and any person who shall kill or destroy said gophers in this State shall be entitled to receive five (5) cents each for every pocket gopher so killed by him, and three (3) cents each for all other kinds of gophers so killed.

SEC. 2. That it shall be the duty of the chairman of the board of supervisors of each town, on the production to him of the dead bodies of all such gophers * * * killed as aforesaid in the town of which said chairman is supervisor, and of which he shall have satisfactory evidence were killed by the person so producing such bodies, to issue his certificate under his official signature to the county auditor of the county * * * giving the number of said gophers so killed and thereupon the county auditor shall draw and issue a warrant on the county treasurer for the amount such person is entitled to receive under the provisions of the preceding section of this act. * * *

SEC. 3. This act shall take effect and be in force from and after its passage. (General Laws of Minnesota for 1887, Chap. 144.)

This act was approved March 8, 1887, and under it bounties were paid by sixteen counties to the amount of $46,197.53. In many of the counties the money was paid largely or exclusively for the destruction of pocket gophers and blackbirds. Those which paid bounties in part for the destruction of spermophiles are shown in the following table. In this State the bounties for spermophiles were paid mainly on the Striped Gopher (*Spermophilus tridecemlineatus*).

Table showing bounties paid on Spermophiles by State of Minnesota.

County.	Rate.	Date.	Total amount paid on spermophiles and other animals.	Total bounty paid by county.	Remarks.
	Cents.				
Becker		1887 1888	$1, 630. 27 2, 982. 12	$4, 612. 39	Probably not more than $100 paid for blackbirds.
Blue Earth		1887	2, 190. 28	2, 190. 28	10 per cent expended for pocket gophers ($219.02).
Hubbard	*3	1888	294. 00	294. 00	
Le Sueur	*3	1888 1889	79. 89 185. 00	264. 89	
McLeod	*3	1887	222. 11	222, 11	For six months.
Martin	*3	1887	13, 000. 00	13, 000. 00	About $225 paid for pocket gophers.
Meeker	*3	1887	981. 84	981. 84	May 1 to Oct. 1.
Nicollet	*3	1887	2, 025. 00	2, 025. 00	May 3 to Dec. 31.
Nobles		1887	1, 997. 24	1, 997. 24	May 18 to Aug. 28, 90 per cent for Striped Spermophiles.
Norman		1887	1, 071. 71	1, 071. 71	June 1 to Nov. 15. This includes a few dozen blackbirds.
Pope	3 ½	1887 1889	† 2, 000. 00 † 2, 100. 00	4, 100. 00	
Renville	3	1887	4, 200. 00	4, 200. 00	$200 paid for pocket gophers.
Scott	3	1887 1888 1889	289. 93 774. 36 1, 078. 34	2, 142. 63	May 16 to Dec. 31. Jan. 1 to Dec. 31. Jan. 1 to Oct. 26, 35 per cent for pocket gophers ($377.41).
Sibley		1887 1888	2, 450. 00	2, 450. 00	May 18, 1887, to Jan. 15, 1888; $250 for pocket gophers.
Wabasha		1887-89	5, 279. 28	5, 279. 28	90 per cent for pocket gophers ($4,751.35).
Winona	3	1887	1, 366. 16	1, 366. 16	May 1 to Nov. 1; 75 per cent for pocket gophers ($1,024.62).
Total				46, 197. 53	
Less bounties on pocket gophers, etc.				7, 147. 40	
Total for spermophiles.				39, 050. 13	

* For Striped Spermophiles. † Approximate.

Montana.—In 1887 Montana offered a bounty of 5 cents each on ground squirrels and prairie dogs. The law took effect March 5 and remained in operation about six months. On September 12, 1887, bounties had been paid on 698,971 ground squirrels, making the total expenditure $34,948.55. During the same period more than $15,000 had been paid for the destruction of prairie dogs, and the money in the treasury having been exhausted the law was repealed without having diminished the number of spermophiles or prairie dogs to any perceptible extent.

Washington.—During the year 1892 the county of Lincoln paid $31,071.06 for the destruction of Townsend's Spermophiles (*Spermophilus townsendi*), according to the report of the auditor dated October 8, 1892. This bounty was paid from February to June, inclusive, at the rate of 5 cents per scalp in February, 4 cents in March, 3 cents in April, 2 cents in May, and 1 cent in June. It is estimated that 1,035,702 scalps were presented. In addition to this a large number of animals undoubtedly escaped only to die in their holes or were killed during the hot weather and their scalps not presented, so that the figures do not show the total number actually destroyed.

The total amounts paid by the seven States for the destruction of spermophiles, as shown by the very incomplete returns received, are as follows:

Iowa	1864–1865 1878–1882 1885–1889	$14, 031. 96
Kansas	1890	5, 000. 00
Minnesota	1887–1889	39, 050. 13
Montana	1887	34, 948. 55
North Dakota	1886–1889	37, 248. 16
South Dakota	1886–1888	2, 173. 23
Washington	1892	31, 071. 06
Total		163, 523. 09

OBJECTIONS TO THE BOUNTY SYSTEM.

The experience of nearly all the States which have paid bounties for the destruction of injurious animals has been that the system is not only very expensive, but unsatisfactory. In the case of Montana the money in the treasury was exhausted before the act had been in operation six months, and yet the numbers of ground squirrels were not perceptibly diminished. The experience of Benton County, Iowa, with pocket gophers also shows the disastrous effects of offering high bounties: In 1866 a bounty of 10 cents per scalp was paid. The following year the bounty was increased to 20 cents, amounting to $10,000. This caused the county to borrow $3,000, and still left gopher warrants unpaid to the amount of $3,000 additional. The bounty was then reduced to 12 cents for six months, then to 10 cents, and was finally abolished in January 1, 1869, the entire amount paid out in three years being about $18,000, but the gopher, although greatly reduced in numbers, was not exterminated.

The result was hardly more successful in the Dakotas and Minnesota, and in several cases the bounties were withdrawn within a few months of the passage of the law. The report received from Nelson County, N. Dak., showed that $4,363.25 had been paid for the destruction of spermophiles between April and July, 1887. The report states: "The attempt to put down the gopher raid was a failure, as it was impossible to follow the 1887 bounties without bankrupting the county. The county has twenty-eight full townships and 227,000 acres under cultivation, which gives too much gopher lands." The county of Griggs, N. Dak., offered a bounty of 3 cents per tail for gophers during the spring of 1887, and reported $5,200.60 paid out before the bounty was withdrawn. Mr. George R. Fralick, of La Moure, N. Dak., wrote in 1888: "This county [La Moure] has expended thousands of dollars to destroy the Gray Gopher, and there are thousands of them yet to destroy our crops."

In Minnesota, under the act of 1887 Meeker County paid bounties from May 1 to October 1, when the payments were discontinued as it was said that there were as many gophers as before, although $14,056.34 had been expended for the destruction of pocket and Striped Gophers. In Nobles County the act of 1887 was accepted May 18, but the bounty was ordered discontinued after August 28. During this period the amount paid was $1,997.24, about 90 per cent of which was for Striped Gophers and the balance about equally divided between pocket and Gray Gophers and blackbirds.

Several counties reported fraudulent payments of bounties. In Ramsay County, N. Dak., tails were received as evidence. This was unsatisfactory, as "it was proved that some of our clever young Americans divided the caudal appendage in two pieces and claimed bounty for each piece, or caught breeders, cut their tails off, and let them go, so as to give them a chance to raise more bounty-producing gophers." The report from Madison County, Iowa, which offered bounties on the several species of gophers indiscriminately, showed that bits of gopher hide with holes cut in them to imitate scalps were presented for payment. "This involved the county in lawsuits, and the bounty on scalps was repealed."

Dissatisfied with the effects of the bounty laws, the commissioners of several counties in North Dakota offered poison free of charge to the farmers for the destruction of gophers. In the year 1888 Benson County distributed $100 worth of strychnine and reported the results satisfactory so far as the extermination of the pests was concerned, although some stock was poisoned. The number of gophers killed during this year was said to be larger than during the previous year under the bounty act. In the spring of the same year Nelson County furnished $200 worth of the strychnine to the farmers, but reported the experiment unsuccessful. Wheat soaked in a solution of poison was used during May and June. These months were wet, and it was supposed that the moist ground destroyed in some measure the effects of the poison. During the years 1887 to 1889 Wells County furnished $500 worth of strychnine and reported the result successful.

In the State of Washington a large amount of money has also been expended in poison for the destruction of Townsend's Spermophile (*Spermophilus townsendi*). Dr. J. W. Lockhardt, of Saint John, Whitman County, under date of June 8, 1892 writes: "I think it no exaggeration to say that the farmers of this county [Whitman] spent $3,000 this year for the poison for this pest and yet many acres of grain are already destroyed."

Evidently a bounty can be but a temporary expedient for the extermination of these or other animals. Even if a sufficient amount of money were appropriated to completely exterminate a species in a given locality, its numbers would soon be reduced to a certain limit where it would cease to be profitable to hunt the animals, and the bounty would consequently become inoperative.

"Bounties offered for the destruction of harmful species seldom accomplish the desired end, and if success does finally result it is only after vastly larger expenditures than were at first thought necessary. After a harmful species—the wolf, for example—has become rather scarce in any section of country the offer of a bounty may lead to its complete extermination; and to attain such a result, it is certainly good economy to make the bounty large. Obviously, it is better to pay a large sum at once for the last few pairs of wolves in a district than to offer a bounty so small that it is little inducement to a hunter to spend his time in their pursuit. In this latter case the wolves easily hold their own for many years, or even increase slowly, while the aggregate bounties paid will far exceed all expectation. In order to be effective a bounty should be large enough to assure the destruction of the great majority of the individuals during the first year, and this is especially true of species which are very numerous and prolific. And yet the amount of money required for the payment of bounties in such cases would be so enormous as to make the plan impracticable."*

A full discussion of this phase of the subject may be found in a section devoted to the question of bounties on the English sparrow.†

METHODS OF DESTROYING PRAIRIE DOGS AND SPERMOPHILES.

Experience has shown that in many ways spermophiles render valuable service to the farmer, but when they are numerous about grain fields they must be disposed of or in some way prevented from attacking the crop, else great loss will be sustained. Still, a wholesale destruction is not to be recommended; unless they do serious damage, spare them for the good they do, and at least let them remain on the prairies and in the meadows and pastures.

The injury which they do to crops, however, is an evil of such magnitude over more than two-thirds of the total area of the United States, that there is a general demand for some economical means of destroying them. The various means used with greater or less success may be divided into four general classes: (1) fire arms, (2) fumigation, (3) traps, (4) poisoning by strychnine and bisulphide of carbon.

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*Bulletin No. 1, The English Sparrow in America, 1889, pp. 153–154.

†Loc. cit., 153–163.

Fire arms.—Under certain circumstances, where not too numerous or too shy, limited areas may be freed from spermophiles by shooting the animals. In California, where the large ground squirrels (*Spermophilus beecheyi*), fairly swarm in some of the valleys, hunters make good wages by shooting them for the market. The meat of the young animals is tender and delicate in flavor and brings almost as high a price as that of rabbits. Ordinarily, however, where the spermophiles are sufficiently abundant to make it worth while to hunt them for profit, they soon become exceedingly wary and difficult to shoot, and it is necessary to resort to some other less expensive and more efficient method to destroy them entirely.

Fumigation.—Various devices have been patented for destroying burrowing rodents, especially ground squirrels, by suffocation. This is accomplished by forcing the smoke of burning straw or sulphur into the burrows by means of 'smokers' or fumigating machines, and the fumes soon overcome the inmates. When the holes have more than one entrance it is necessary to take the precaution to close all but one to prevent the escape of the smoke. When the work is done thoroughly this is often a very efficient means of destroying the pests. The disadvantages, however, arising from the fact that the fumigating machines are more or less expensive, as well as somewhat unwieldy to carry about, render this method of less value than the simpler ones of trapping or poisoning.

Traps.—Trapping is slower than poisoning, but has the advantage in being simple and safe. Few animals are more readily taken in this way. Several special kinds of traps are in use, but for ordinary purposes the No. 0 steel trap with the spring under the pan will be found as good as any. This is the smallest steel trap made, and is quite an improvement over the ordinary steel trap with side springs, as it is equally strong and much more easily concealed. The trap securely fastened by its chain should be set at the mouth of the hole, lightly covered with fine earth, and baited with almost any kind of grain. Bait is not always necessary, and in the case of a few of the species it is unnecessary even to cover the trap.

POISONING.

Strychnine and bisulphide of carbon are the most speedy and effective poisons for the destruction of prairie dogs, ground squirrels, and pocket gophers.

Strychnine.—In general, the scattering of strychnine about promiscuously is to be avoided on account of the danger to animals other than those for whom it was intended. In certain cases, however, it may be used to advantage, as shown by the practical experience of Mr. Rollin C. Cooper, of Cooperstown, N. Dak. He writes, under date of November 28, 1888:

"I am farming 7,000 acres, and the gopher question has been one of great interest to me. I now think that I have the best of them and can rid my farm of them at little expense. I send men over my fields about twice in the spring, the first time as soon as the animals commence coming out of their holes, with wheat soaked in strychnine water. I use one ounce of floured strychnine to each bushel of wheat. Every farmer can flour his own strychnine with a caseknife on any piece of iron or glass; it should then be put into quite warm water, dissolving the strychnine fully. Pour on water until the wheat is nicely covered, letting it stand the necessary time. Soak the wheat twenty-four to thirty-six hours, or until somewhat soft. When sufficiently soaked each man takes a teaspoon and a small can and walks over the fields, putting one teaspoonful into each hole. This being carefully done a couple of times each year will soon clean the animals out, and will greatly repay the farmer, even if repeated every year, as one man can go over 50 to 100 acres per day."

Under this head should be mentioned the numerous brands of squirrel poison or squirrel exterminators which have been put on the market during recent years. These consist of grain, usually wheat, prepared with strychnine or other poison ready for use. The different brands have proved of varying value, but several of them have been highly recommended, and in use have proved eminently successful as well as economical.

Bisulphide of carbon.—One of the simplest means and probably the most effective and cheapest method yet devised for destroying these animals is by the use of bisulphide of carbon. This compound when pure forms a colorless, mobile liquid having a peculiar odor, and when taken internally is a violent poison. As usually obtained it contains impurities in the form of other compounds of sulphur which give it a strong and extremely offensive odor, and when inhaled it soon causes death. For the purpose of destroying gophers or ground squirrels the crude bisulphide is better and much cheaper than the pure article. Care should be taken in using the liquid, as it is both inflammable and explosive. Its efficacy depends on the fact that its vapor is heavier than air and when introduced into burrows flows like water into all the recesses. This should be borne in mind in using it on sloping ground or in places where there is reason to suppose that the holes contain water, for unless the poison is introduced at the highest opening of the burrow a certain part of the hole will remain free from it and here the animals may take refuge. If the holes contain water, this may act as a water trap preventing the diffusion of the vapor.

The method of use for burrowing mammals is as follows: A small quantity (about 45 cubic centimeters or 3 tablespoonfuls for prairie dogs, and 30 cubic centimeters or 2 tablespoonfuls for spermophiles and pocket gophers) should be poured upon a bunch of rags or waste, which should be immediately placed within the mouth of the burrow, and the hole closed.

EXPERIMENTS WITH BISULPHIDE OF CARBON.

A few simple experiments have been made in killing small mammals with bisulphide of carbon. The species upon which the experiments were tried were such as could be readily procured—skunks, prairie dogs, striped spermophiles, pocket gophers, and the common rat. In most cases far too much of the liquid was used, but the object was mainly to determine the quantity necessary to kill animals of various sizes. The animal after being caught in a trap, was fastened by a string and allowed to enter its hole. A measured quantity of liquid bisulphide of carbon was then poured into the hole, the mouth of which was usually covered, and the time required for the animal's death noted. By means of the string they were drawn out of the holes, and if not dead, replaced until they were. Following are some of the experiments:

Wichita Falls, Tex., August, 1892.—(1) A prairie dog, fastened by a strong cord, was allowed to enter its hole. It carried down 12 feet 10 inches (3.9 meters) of cord. The hole measured 4 inches (100 millimeters) in diameter. I poured in 49 cubic centimeters of bisulphide (about 3 tablespoonfuls), and in eight minutes drew out the prairie dog, dead.

(2) Another prairie dog fastened by a cord was allowed to enter its hole 8 feet 3 inches (2.5 meters). The hole was 5¾ inches (145 millimeters) in diameter. I poured in 49 cubic centimeters of bisulphide and in five minutes drew out the prairie dog, dead.

(3) Another was allowed to go down its hole about 10 feet (3.04 meters). I poured in 49 cubic centimeters of bisulphide, and in five minutes the prairie dog was apparently dead, but caught in the hole, and I broke the string in trying to draw it out.

(4) Another prairie dog with string attached entered its hole 4 feet 3 inches (1.3 meters). Poured in 49 cubic centimeters of bisulphide, and in six minutes drew out the dead prairie dog.

(5) Another with its foot in a trap went down the hole 14 inches (355 millimeters). I poured in 29 cubic centimeters (2 tablespoonfuls), of bisulphide and covered the hole. In five minutes the prairie dog was still alive. The gas had passed by it and filled the lower part of the hole, but had not filled it high enough to reach the prairie dog. From the effects of the gas it was nicely anæsthetized and did not revive for two or three hours.

(6) A Striped Spermophile (*S. tridecemlineatus*) was allowed to go down its hole 14 inches (355 millimeters). Poured in some bisulphide, and in six minutes drew out the spermophile dead.

(7) Caught a skunk by one foot in a steel trap. It had crawled

down a hole the length of the trap chain—about 14 inches (355 millimeters). Eighty-three cubic centimeters of bisulphide was poured into the hole, and in five minutes the skunk was apparently dead, though its heart was still beating. It had not discharged its scent fluid. I handled it freely, rolling it about on the ground, but it could not move. I put it back in the hole, and upon returning three hours later found that it had revived.

Canadian, Tex., August 28.—(8) Caught a little spotted skunk (*Spilogale*) in a trap; dug a hole 10 inches (250 millimeters) deep and drew the skunk along till it fell into the hole. After throwing some dry grass over the hole 18 cubic centimeters (about a tablespoonful) of bisulphide was poured on it. In six minutes the skunk was dead and had not discharged its weapon of offense.

(9) A pocket gopher (*Geomys*) was allowed to enter its hole for a distance of 5 feet (1.5 meters). Poured in bisulphide and in five minutes drew out the gopher not quite dead.

Woodward, Okla., August 29.—(10) Another pocket gopher entered its hole for a distance of 8 feet (2.4 meters). Poured in 36 cubic centimeters of bisulphide. In six minutes the gopher was not quite dead, and after a time revived.

(11) I let a pocket gopher, with a string attached, enter its hole a distance of 4 feet (1.2 meters) and poured in 29 cubic centimeters of bisulphide. In six minutes it was not dead. I put it back in the hole and in three minutes more took it out dead.

(12) A pocket gopher, with string attached, entered a hole 2 inches (50 millimeters) in diameter, a distance of 10 feet (3 meters). Poured in 44 cubic centimeters of bisulphide. In ten minutes the gopher was not affected. I dug out the hole and not only found that it forked between the animal and the entrance but was packed with fresh dirt, thereby preventing the fumes from being effective.

Kiowa, Kans., August 31.—(13) A pocket gopher was placed in a hole 6 inches (150 millimeters) from the entrance and 29 cubic centimeters of bisulphide of carbon poured in. Six minutes later the gopher was only stupefied and soon revived; the gas had passed by and flowed down the hole.

Washington, D. C.—(14) Three half-grown brown rats (*Mus decumanus*) were separately placed in a 2-liter glass jar and subjected to various quantities of bisulphide of carbon.

With 250 cubic centimeters,
200 cubic centimeters,
150 cubic centimeters, the rat died in four minutes.

With 100 cubic centimeters the rat survived.

These experiments were entirely satisfactory so far as properly carried out, but were too few to afford a basis for definite conclusions. The results are shown in the accompanying table:

Tabular statement showing results of experiments in poisoning small mammals with bisulphide of carbon.

No.	Species.	Distance from mouth of burrow.	Diameter of burrow.	Amount of bisulphide.	Time.
		Inches.	*Inches.*	*Cubic cm.*	*Min.*
1	Prairie Dog (*Cynomys ludovicianus*)	154	4	49	8
2	do	99	5¾	49	5
3	do	120		49	5
4	do	51		49	6
5	do	14		29	(*)
6	Striped Gopher (*Spermophilus 13-lineatus*)	14			6
7	Common Skunk (*Mephitis mephitica*)	14		83	(†)
8	Little Spotted Skunk (*Spilogale*)			18	6
9	Pocket Gopher (*Geomys bursarius*)	60			‡5
10	do	96		36	6
11	do	48		29	9
12	do	120	2	44	§10
13	do	6		29	*6

* Vapor passed by and did not completely fill burrow. At end of time the animal was anæsthetized, but revived.

† Anæsthetized in five minutes; revived three hours later. ‡ Not quite dead. § Not affected.

Prof. E. W. Hilgard, of the University of California, deserves the credit of originating the bisulphide method of destroying burrowing mammals. In a bulletin 'On the destruction of Ground Squirrels by the use of Bisulphide of Carbon,' published in 1878, he gives the results of experiments made on the California Ground Squirrel (*Spermophilus beecheyi*) as follows:

"It is hardly necessary to enlarge upon the importance to California agriculture of devising some ready, safe, and effectual means of putting an end to the constantly increasing inroads of the ground squirrel upon the grain fields and pastures of the State. Unlike most other wild animals, whose range diminishes as culture advances, the ground squirrel finds an improvement of the conditions of its existence as the area of cultivation increases. Each year we hear of its taking possession of 'fresh fields and pastures new,' while rarely loosening its grip upon any district once invaded; and the tax it levies upon the grain-growers of some counties exceeds all the other taxes combined. The damage done during the past season in Contra Costa County alone was estimated by the board of supervisors of that county at not less than $150,000, while in many individual cases from 30 to 50 per cent of the crop was harvested by the squirrels before the reaper could take the field."

After describing the properties of bisulphide of carbon and some of its uses he goes on to say:

"It is curious that in no case have I known a squirrel to run out of the holes before the gas; when it meets it face to face in a run, death seems to be almost instantaneous. But in most cases the animals seem to retire to their nests to die there in a stupor. The mode of proceeding is simply this: Select one or two of the freshest holes in a burrow, introduce into it, as deep down as you can reach, a wide-mouthed ounce vial full of the liquid, upset the vial, and withdraw it. * * * The holes may all be closed at once, with earth, which need not be rammed;

the only object being to keep the gas in, and to see if any of the inmates dig out afterwards. * * * The dead animal is thus buried and out of sight in his own burrow, creates no stench and poisons nothing; its flesh would not be injurious even if dug up. No other wild or domestic animal runs any risk, unless it be the gopher. The holes retain an offensive odor for some time, and remain closed and untenanted. * * * As for the expense of this method, I have freed the most thickly-peopled portions of the University campus (level ground) from every vestige of squirrels with about a pound of the liquid per acre; about half an hour being spent by two men in closing the holes with shovels.”[*]

During the past five or six years this remedy has been recommended by the Division, and has been used with success by numerous correspondents. Mr. Joseph Conaster, of Sunset, Wash., who was much troubled by the depredations of Townsend’s Spermophile, after using the poison, wrote under date of July 20, 1892:

“I think your bisulphide will exterminate the squirrels. Have annihilated two towns of them that I have been shooting and poisoning for three years. Did it all in two hours and am satisfied that the bisulphide will be the grand remedy of all.”

KEY TO THE SPECIES.

The area covered by this bulletin includes the ranges of five spermophiles. One of these, Kennicott’s Spermophile, is a sub-species of the peculiar Sonoran Spermophile (*S. spilosoma*). A sixth form, the Wyoming Spermophile, closely related to *Spermophilus richardsoni*, will be mentioned and its distribution included under the latter species, as data is wanting to limit the ranges of the two animals.

These five species differ widely from one another in coloration, and may be readily distinguished by the colors and markings of the back. For convenience in identification they are here divided into three groups as shown below.

KEY TO THE FIVE MISSISSIPPI VALLEY SPERMOPHILES.

1. Back striped lengthwise.
    (*a*) With solid stripes alternating with rows of spots, *Spermophilus tridecemlineatus.*
    (*b*) With rows of spots without any solid stripes...... *Spermophilus mexicanus.*
2. Back irregularly and indistinctly spotted.
    Size small, tail short and slender............ *Spermophilus spilosoma obsoletus.*[†]
3. Back not distinctly striped or spotted; size large.
    (*a*) Tail long and bushy, gray.......................... *Spermophilus franklini.*
    (*b*) Tail short, buff below, blackish above............ *Spermophilus richardsoni.*

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[*] Bulletin of the University of California, No. 32, April, 1878.

[†] This spermophile inhabits western Nebraska, and is gray in color, with blackish edgings to the spots. It belongs to the *Spermophilus spilosoma* group, most of the members of which are yellowish brown in color. They are not mentioned in the present report because the main part of their range is to the south and west of the area here treated. Representatives of the group however occur in southern and western Texas and eastern Colorado.

STRIPED PRAIRIE SPERMOPHILE.

Spermophilus tridecemlineatus (Mitchill).

[Plate I—Map 1.]

Description.—This is the slenderest of the spermophiles, with ears about an eighth of an inch long; the tail is about half as long as the head and body, flattened and slightly bushy. The belly and lower sides, including legs, feet, throat, nose, and lower half of cheeks, are dull buff or ashy buff; the back is striped with six narrow buff colored lines and seven wider lines of dark brown, each brown line inclosing a row of small spots. Along the middle of the back the stripes extend from the top of the head to the tail, becoming shorter on the sides.* Specimens inhabiting the arid plains are considerably paler than those from the prairies of the Mississippi Valley proper, and have been separated as a subspecies under the name *Spermophilus tridecemlineatus pallidus.*

The following measurements were taken from a specimen selected from fifteen adults as representing the average size: Total length from end of nose to tip of tail vertebræ, 252 millimeters (10 inches); length of tail (turned at right angles to back and measured with dividers from angle at base to tip of vertebræ) 88 millimeters (3½ inches); length of hind foot from point of heel to tip of longest claw, 33 millimeters (1¼ inches).

Range.—This well-known little animal is widely distributed throughout the central part of North America, ranging continuously from eastern Michigan to Montana and Colorado, and from central Texas north to the plains of the Saskatchewan in Canada, where it reaches latitude 53° N.

Its range embraces all of the five States of North and South Dakota, Iowa, Nebraska and Kansas, and practically all of the Territory of Oklahoma. North of the United States recent observations have failed to carry it beyond Carlton House, Saskatchewan, where it was found more than sixty years ago. Its eastern limit may be indicated by a line following the Red River valley southward to Pembina, N. Dak., and then running diagonally across Minnesota through Crookston, Park Rapids, and Fort Ripley, to the Wisconsin border near Pine City. Wisconsin records are mainly confined to the southeastern part of the State, although it has been found at Sparta and reported as far north as Ripon. In Michigan the northernmost records are Big Rapids, Byers, Palo, and Matherton. *Spermophilus tridecemlineatus* barely enters Ohio and is restricted to the northwestern part of Indiana, not passing east of the Wabash River according to Mr. F. C. Test. The most southern point in Illinois from which it has been reported is Belle Prairie. Harrisville and Golden, Mo., and Ardmore, Ind. Ter., are near its southeastern limits, while Point, Meridian, Clyde, and Epworth, Tex., mark the southern limits of its distribution so far as known. The western limits of its range are roughly indicated by Fort Garland, Twin Lakes, South Park, and Denver, Colo.; Green River and Douglas, Wyo.; and Fort Custer, Park City, and Chief Mountain Lake, Mont. Specimens have been taken by Mr. E. W. Nelson, at Springerville, Ariz., and the species has been recorded from several places in western New Mexico and Colorado, but the relation of these points to the main area of distribution is not at present clear.

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* An animal frequently confused with this species is the chipmunk (*Tamias striatus*), which has the middle of the back striped with black, buff, and brown, but no spots, and is further distinguished by a more bushy tail and longer ears. It is a forest animal and climbs trees, while the Striped Spermophile belongs to the prairies and does not climb trees.

In short, it occupies all of the prairie region east of the Rocky Mountains and is a true prairie-dweller, never entering a timbered region any more than the tree squirrels wander from their forest homes. But as the timber is cleared off and the country brought under cultivation, it frequently follows the fields and spreads to considerable distances from its original haunts. In Michigan forty years ago it was restricted to the few small prairies of the southern part of the State; to-day the southern half of the State is nearly as open as the original prairie country and the spermophiles have spread over it as far north as Big Rapids in Mecosta County. In Minnesota I have observed a similar extension of range, though on a smaller scale. When the timber was removed the spermophiles came in from adjoining prairies and were found about fields previously unoccupied by them. The westward range of the species is limited by the Rocky Mountains, over which they do not pass, although they have penetrated well into the valleys on the east slope and even into some of the mountain parks.

Habits.—Throughout the prairies of the Mississippi Valley the little Striped Spermophile is a familiar object as it darts through the grass to its hole, or is seen standing upright on its hind feet, straight and motionless as a stick. With its short ears, smoothly rounded head, and the forefeet drooping at its sides, there is no point about its outline to catch the eye, and at a little distance it is impossible to distinguish it from an old picket pin or tent stake. While hunting spermophiles I have frequently passed what I mistook for a stake only to hear from it a shrill chatter, and as frequently have cautiously approached within 3 or 4 rods of a supposed spermophile before discovering that it was only a peg of wood. Standing thus, the animal will often allow one to approach within a few yards, then quickly dropping on all fours it utters a shrill chatter and dives into a hole close by. Remain quiet for a few minutes, and its head reappears at the entrance of the hole and the little black eyes peer at you curiously. Walk away from the place and it will soon come out and, standing up again, watch you as long as within sight, uttering an occasional note of alarm or warning to its friends. Its note is a rapid trill or trembling whistle, a long drawn-out chur-r-r-r-r in a high key.

Richardson ascribes to this species a quarrelsome disposition, and says: "The manners of the Leopard-marmot are similar to those of *A. richardsoni*, but it is a more active animal and of a bolder and more irritable disposition. When it has been driven to take shelter in its burrow it may be heard expressing its anger in a shrill and harsh repetition of the syllable *seek-seek.* * * * The males fight when they meet, and in their contests their tails are often mutilated. I observed several individuals which had been recently injured in this way, and it is rare to meet a male which has a tail equaling those of the females in length." (Fauna Boreali-Americana, 1829, p. 177.)

It is not surprising that an animal so characteristic of prairies should not take kindly to trees. I never saw one try to climb a tree, and did not suppose that such an attempt would prove successful, but Mr. Ernest E. Thompson, in writing of their habits, says: "Although the species is supposed to be strictly terrestrial, Mr. R. M. Christie and myself twice observed a gopher climb up a low spruce tree in pursuit of a bay-winged bunting (*Poocœtes gramineus*), that was perched on the top."*

The Striped Spermophile depends for shelter and protection on burrows which it digs in the ground. These burrows are about 2 inches in diameter, descend steeply for a short distance, and then extend off horizontally. Sometimes a hole longer than usual rises nearly to the surface and then dips down siphon-like, leaving a wall between the entrance and the nest. Many of them are short, and seem to be used only to dodge into at the approach of danger, and a bucket of water poured into one will often force out the occupant half drowned and gasping for breath. The tunnels leading to the nests in which the animals spend the winter and raise their young commonly extend 15 or 20 feet, but are not more than a foot, or at most 2 feet, below the surface. Though many of the burrows open on smooth bare ground with nothing to conceal them, the entrances are more commonly hidden by a bunch of grass, and sometimes a dried weed, a piece of paper, or an old rag is drawn over the entrance.

During the breeding season these spermophiles are quiet and shy, but in June and July when the half-grown young begin to make their appearance above ground their voices are most frequently heard. The parent and her young at this time are constantly calling back and forth, and never wander far from one another. The number of young in a litter seems to vary from seven to ten. In some cases higher numbers still have been reported. Mr. W. W. Gilman, of Stoughton, Dane County, Wis., writes that while in Freeborn County, Minn., he examined a number of pregnant females of this species, and found the embryos to number from nine to fourteen. None of those which I have examined contained more than eight embryos, and the number of mammary nipples of the female varied from eight to twelve.

Richardson mentions a female killed, May 17, at Carlton House, on the Saskatchewan River, that contained ten young.†

Mr. Ernest E. Thompson, who has carefully observed the habits of this species in Manitoba, both in captivity and in a wild state, says that the young are born late in May and usually number eight or nine. Robert Kennicott says: "The young are produced at the end of May or early in June. I have observed from five to nine brought forth at a birth, and I am informed of two instances in which ten were found in a nest; but the number is variable, the usual number being six or seven. The young at birth are naked, blind, and remarkably embryonic. Dr. Hoy, who has observed them in confinement, says that they have no hair on the body before they are twenty days old and the eyes do not open till the thirtieth day. They continue to require nourishment and care of the mother for a much longer period than most rodents. During summer they begin to dig shallow burrows and leave her before winter to shift for themselves. Hibernating mammals require to be in good condition when they retire to winter quarters, which females could scarcely be did they rear young late in the season. This spermophile and probably the rest of the genus produce but one litter a year." (Rept. Comm. Patents for 1856, pp. 76–77.)

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* Trans. Hist. and Sci. Soc. of Manitoba, No. 23 (1886), 1887, p. 14.

† Fauna Boreali-Americana, 1829, p. 178.

Appearance in spring.—Towards fall the spermophiles become very fat, and after a few frosty nights, long before snow comes or the ground freezes, they vanish into their holes and do not appear again until the ground thaws in spring. In southern Minnesota they are rarely seen above ground later than the 1st of October or in spring before the 1st of April. Dr. Thomas S. Roberts, of Minneapolis, reports their first appearance in the spring of 1877 on April 5; in 1878, March 17; and in 1879, April 5.

Robert Kennicott says: "To Mr. William Webb, of Fountaindale, Winnebago County, Ill., I am indebted for the following dates of this spermophile's first appearance in spring, as noted in the meteorological register of Mr. Edward Bebb: '1851, April 10; 1852, April 11; 1853, April 2; 1854, March 29; 1855, April 12.'" (Rept. Comm. Patents for 1856, p. 77.) Mr. Plummer L. Ong, of Hennepin, Putnam County, Ill., reports the first one seen at that place in the spring of 1884, on March 24. Mr. O. A. Kenyon, of McGregor, Clayton County, Iowa, reports them as active on April 13, 1887, and Mr. Evelen Brown gives the dates of their first appearance at Bathgate, Pembina County, N. Dak., as March 29, 1889, and April 16, 1890. At Beloit, Kit Carson County, Colo., Mr. H. G. Hoskin reports their first appearance in the spring of 1890 on March 10. In Manitoba Mr. Ernest E. Thompson reports their first appearance at Carberry in spring about April 20, and says that they are not seen after the 1st of October.*

Whether they remain dormant all of the six or seven months which are spent underground is difficult to determine, but it seems probable that they do not. Large stores of grain and nuts are carried into the holes in autumn and stored close to their nests. Whether these are eaten during the winter or saved for use in the spring when grain and seeds are scarce remains to be ascertained.

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* Rept. Dept. Agl. and Statistics, Prov. of Manitoba, 1882, pp. 169-172.

Hibernation.—The observations of the late Dr. P. R. Hoy on the hibernation of this spermophile add much to our knowledge not only of its habits but to the subject of hibernation.

He states: "The following are the results of many observations and experiments on the Striped Gopher (*Spermophilus tridecemlineatus*) during active life as well as when under the profound stupor of hibernation. During activity the gopher's pulse is 200; respiration, 50; temperature, 105.

"On the second of October, having procured a Red Squirrel (*Sciurus hudsonicus*) and a gopher, animals of nearly equal size, the one active during the coldest weather, while the other is a characteristic hibernator, I cut out a part of the gluteal muscles of each, and after dividing and bruising, so as thoroughly to break up every part, I took 50 grains of each and placed in a test tube, into which I put 2 ounces of cold water. After freely agitating, the mixture was left to digest for eight hours, at the expiration of which time I carefully decanted and renewed the water, agitated and left twelve hours, then filtered and rolled the residuum on blotting paper, in order to remove all excess of moisture. When weighed they stood: gopher, 50–15; squirrel, 50–10. These experiments were repeated with substantially the same results. Gluteal muscles of the squirrel contained 20 per cent of albumen, soluble in cold water, while the same muscles of the Striped Gopher treated in like manner, at the same time, yielded 30 per cent.

"As it is well known that the flesh of reptiles is rich in albumen, I procured several marsh frogs and subjected the gluteal muscles to like analysis, which resulted in 40 per cent of loss. The following will convey to the eye these results:

Per cent of soluble albumen: Frog, 40; gopher, 30; squirrel, 20.

"On the 15th of December, the gopher being thoroughly torpid, temperature of the room 45, gopher rolled up like a ball, no visible evidence of life, I opened the abdomen and inserted the bulb of a thermometer which indicated 58°. I next turned back the sternum in such a manner as to expose the heart and lungs. The remarkably congested condition of these organs first attracted my attention; in fact, it would appear as if all the blood had collected within the thorax. The pulsation of the heart was reduced to four each minute, the auricles would slowly and imperfectly contract, followed immediately by the ventricles. These slow pulsations of the heart occupied four seconds. There was no visible respiration, the lungs remaining almost entirely passive. The heart continued to pulsate, without perceptible change, for fifteen minutes, and then when raised from its position it continued to pulsate for some time, being almost reptilian in this respect. During hibernation the circulation is so feeble that when a limb is amputated but a few drops of blood will slowly ooze from the fresh wound. The stomachs and bowels empty, and the body was inclosed in a thick adipose layer. I was not able to excite the least motion or contraction of the muscles in any way, even by pinching or cutting nerves, showing the most perfect condition of anæsthesia possible.

"During hibernation the gopher is not able to endure more than 6° or 8° of frost. The manifestations of life are so feebly performed that a few degrees below freezing is sufficient to convert apparent death into the reality. On the 10th of April, at which time the first gopher appeared above ground, I repeated the experiment of the previous autumn. Body emaciated, hair dry and lifeless, flesh perceptibly less moist than it was in the fall. On subjecting the gluteal muscles to like treatment as in October, I was surprised to find only 18 per cent of loss instead of the 30, as exhibited in the previous autumn.

"The large amount of soluble albumen found in the flesh of the Striped Gopher in the fall, and the lesser amount found after its protracted hibernation, go far to prove that albumen somehow fits the animal for its long sleep. Is it not probable that albumen is a stored-up magazine of elaborated nutrition to be used when no food can be assimilated by the digestive organ?"*

INJURY TO CROPS.

Many replies have been received to letters sent out by the Division of Ornithology and Mammalogy inquiring as to the injury done by Striped Spermophiles and other species in the Mississippi Valley. Reports from correspondents in all the States where these animals occur agree that they cause serious damage to the crops. The following extracts from letters will give some idea of the extent and nature of their ravages.

Minnesota.—Mr. George Little, county treasurer of Lyon County, reports: "Striped Gophers increase or decrease very rapidly according to favorable or unfavorable conditions. A succession of dry years is especially favorable to their increase, while a succession of wet seasons reduces their numbers very rapidly, probably by flooding their nests. They have been very numerous this season [1888] and very destructive to corn immediately after planting; whole fields, in some instances, have been entirely destroyed, and it is a rare thing to see or hear of a field that has not been damaged." Peter Skoglund, of Lake Andrew, Kandiyohi County, writes under date of November, 1889: "The common Striped and Gray Gophers do more injury to our grainfields than any other mammals. They begin before the grain ripens, cutting down, consuming, and storing away for winter use. I have lost about 20 bushels from this cause."

Iowa.—In Butler County Mr. W. Head, of Bristow, writes under date of January 5, 1887: "The common Striped Ground Squirrel or Gopher is a great pest on the farm. When corn is just peeping through the ground they will follow a row and pull up the hills and eat off the kernel. Last year I found the hills pulled up for rods in one place. They are also destructive to wheat. My father had a wheatfield by the side of a new piece of ground which was full of gopher burrows. I was set to trapping them and found in their holes heads of wheat which had been entirely shelled out. The breaking was strewn with straws and wheat heads which had been shelled out and the grain carried into their holes." Mr. John N. Houghton, of Grinnell, Poweshiek County, says (March 23, 1891): "*Spermophilus tridecemlineatus* is very abundant. During the past summer I have seen twenty-five during a walk of a quarter of a mile. As to its destructive traits, it is prominent chiefly in destroying young corn. * * * The past summer it destroyed a half acre in a piece of 4 acres belonging to me. I have seen it catch and consume the cabbage butterfly repeatedly, and have also watched it digging for cutworms. These are cases of traits beneficial to the farmer, I am positive."

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*Proc. Am. Ass. Adv. Sci. Aug. 1875, pp. 148–149.

Nebraska.—Mr. Lawrence Bruner, of Lincoln, reports three species present, *Spermophilus tridecemlineatus*, *S. spilosoma obsoletus*, and *S. franklini*, of which the first is by far the most common and very destructive to young corn. In Buffalo County Mr. R. W. Thatcher, of Gibbon, says: "The Striped Gopher, 'Line-tailed Spermophile'* and badger are all destructive to grain. The first two are very much more common this year than ever before. They work much alike and mostly upon corn, digging down to the seed and then eating it. They have been known to follow the planter and dig up every hill for several rods. They do not stop when the corn sprouts, but continue to dig until the seed has all been absorbed. Formerly they lived in holes on the prairie, and worked only on the edge of a field, but this year [1888] they have dug their holes in the fields, eating the corn all around them. They occasion great damage to the corn crop and are killed mercilessly by all the farmers. We have a field of corn which was planted May 23. Owing to the cold, backward spring it was late in coming up, and we could not begin working it until June 9. During the first day's work I counted the number of hills dug up in several rows. I found the average to be about forty-five hills to the row of 120 rods. The next time I was at work I saw a gopher catch and kill a field mouse, which is something I have never seen them do before. I do not know what caused the gopher to do so, for as soon as I approached it, it dropped the mouse and ran into its hole. The mouse was badly bitten." [Letter dated June 19, 1888.]

From Turlington, Otoe County, Mr. William N. Hunter writes: "The Striped Gopher (*Spermophilus tridecemlineatus*) is the worst enemy of the farmer in this county during the time of corn planting, digging up large amounts of corn just after it is planted. I know of one instance this spring where a farmer had to plant over 10 acres, so completely had the gophers destroyed the field. In spite of the constant warfare on these gophers by farmers they continue to increase. I found one female that would have produced twelve young, and seven to ten is a common average." [Letter dated May 29, 1891.]

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* The true Line-tailed Spermophile (*Spermophilus grammurus*) is a Rocky Mountain species and does not occur in Nebraska. The species here referred to is undoubtedly Franklin's Spermophile (*S. franklini*). Gibbon is near the western limit of its range.

Kansas.—In Kansas Mr. George Briggs, of Reeder, reports that in Kiowa County, Striped Gophers live on the prairie around the edge of the fields and dig up seed corn in the spring. Patches of from 1 to 5 rods in extent were destroyed around the outside of all the cornfields in the neighborhood of Reeder in 1888, and the damage was so great that in some cases the farmers had to replant. Prof. L. L. Dyche, of Lawrence, Douglas County, writes: "The Ground Squirrel (*Spermophilus tridecemlineatus*) digs up corn, squash, melon, and other seeds soon after they are planted. Farmers say that these Ground Squirrels can smell the seeds, for they always dig straight down to them. Some watermelon farmers report that the squirrels frequently stop the growth of a vine by nibbling or cutting off the tender runners near the end. Cases were reported where they cut holes in the nearly ripe muskmelons and watermelons and ate the seed out."

Colorado.—Mr. Horace G. Smith, jr., of Denver, writes under date of September 16, 1888: "I have resided some fifteen years in Denver. The Striped Gopher (*Spermophilus tridecemlineatus* or an allied species) is common everywhere on the plains and is occasionally seen in timber along the streams. It does more or less damage by digging up seeds, particularly corn and melons. They skip about over the field, digging up a hill here and there. I have known instances where it was necessary to replant melons in order to get a stand, though three or four times the required seed was planted the first time. These spermophiles are easily killed by placing poisoned grain at the entrances to their burrows. Their natural food seems to be grasshoppers, grass, and leaves of other plants, seeds, etc. The cactus furnishes a large amount of food for them; the cap of the ovary is cut away, exposing a thimbleful of seeds on which they feed. I have seen them occasionally in the top of *Psoralea lanceolata*, a bushy plant of the pea family, on the seeds of which they feed.

"I have found the feathers of the shore lark (*Otocoris alpestris arenicola*) about the entrance to their burrows on one or two occasions, but whether killed by the squirrel or not I do not know, though I have known it to turn cannibal when several were kept together in confinement. The shore lark evidently regards them as enemies, for I have often seen them try to drive the spermophiles from the locality of their nests, and have found the eggs of this species, as well as those of the lark bunting (*Calamospiza melanocorys*), destroyed, as I supposed, by this spermophile."

FOOD.

The name *Spermophilus*, meaning seed-lover, is particularly appropriate for this species. Scarcely a seed or grain grows where they live that they do not eat. The following list includes only such as I have seen them in the act of eating or have found in their cheek pouches or stomachs: Wheat, oats, barley, rye, corn, acorns, hazelnuts, seeds of mountain rice (*Oryzopsis micrantha*), feather grass (*Stipa spartea*), pigeon grass (*Setaria*), millet (*Setaria italica*), wild sunflowers (*Helianthus*), pigweed (*Chenopodium*), bindweed and knotweed (*Polygonum*), puccoon (*Lithospermum*), three species of prickly pear (*Opuntia missouriensis*, *O. fragilis*, and *O. rafinesqui*), ragweed (*Ambrosia*), buffalo peas (*Astragalus caryocarpus*), *Hosackia purshiana*, and common locust (*Robinia pseudacacia*). But their food is by no means restricted to seeds, for they are fond of various fruits, roots, insects, lizards, mice, and any kind of fresh meat. They eat the fruit of the prickly pear (*Opuntia rafinesqui*), strawberries, green foliage of numerous plants, roots of sorrel (*Oxalis violacea*), and wild larkspur (*Delphinium azureum*).

Animal food forms a part of their diet and they feed especially upon such insects as grasshoppers, beetles, caterpillars, and ants. They seem to like any kind of fresh meat and have troubled me a great deal by eating small mammals caught for specimens. In traps set with much care for various kinds of mice (*Sitomys*, *Perognathus*, or *Arvicola*), I have frequently found only the strips of skin with feet and tail attached to show where a rare specimen had disappeared; and on opening the stomach of the spermophile caught near the place have found in its stomach the flesh of the lost specimens. Moreover, they are true cannibals, devouring the dead bodies of their own species. They tear the skin in strips and eat out the flesh. Mice are usually eaten bones and all, and frequently nothing but bits of torn skin and the feet and tail are left. I once shot a spermophile as it was sitting up eating something that it held in its paws. On picking it up a partly devoured lizard (*Eumeces fasciatus*) was found, and several joints of the lizard's tail were in the spermophile's cheek pouches. Prof. F. E. L. Beal informs me that at Ames, Story County, Iowa, he once saw a Striped Spermophile with a large hairy caterpillar in its mouth, and on another occasion saw one carrying a field mouse.

Prof. Herbert Osborn, of Ames, Iowa, contributes the following interesting account of their food habits: "Early in June I noticed the Striped Ground Squirrels on the college lawn digging into the turf and eating something which they withdrew. Examining the places thus dug up I always found the peculiar cocoon of a *Crambus*, and the place would also show the deserted web and burrow of the larva. These squirrels' burrows were very numerous in some parts of the lawn; and in one place I counted twenty-five in the space of a square yard, indicating that the ground squirrel had disposed of that many larvæ or pupæ of *Crambus* within the given area. At another time I counted fifty to the square yard. Evidently when sodworms are plenty the ground squirrel is not an unmixed evil." (Ann. Rept. U. S. Dept. Agriculture, 1887, p. 155.)

Prof. C. P. Gillette, in Bulletin No. 6 of the Iowa Experiment Station, published in 1889, gives the results of the examination of twenty-two stomachs of this spermophile, made at Ames, Iowa. The animals from which the stomachs were taken were killed on various parts of the college farm, and at intervals from April 19 to August 2. As a result of this examination it was found that insects formed 46 per cent of the stomach contents, with an average number of thirteen cutworms and webworms in each. "The webworms in these stomachs were, in the great majority of cases, the larvæ of *Crambus exsiccatus* which is very injurious to corn and grass in Iowa, its work in corn being very often mistaken for that of cutworms." In conclusion it is stated that "the insects which the squirrels feed on are almost exclusively injurious species, chief among which seem to be cutworms, webworms, and grasshoppers. As grass, clover, and other green stuff has been abundant wherever the squirrels were taken, and as their stomachs were often gorged with insects that must have given them much trouble to catch, it would seem that they prefer the latter food" (page 242).

In Bulletin No. 30 of the Agricultural College and Experiment Station of Brookings, S. Dak., are given the results of an examination, by J. M. Aldrich, of the contents of fifteen stomachs of the Striped Spermophile. As relative amounts of the different materials found in the stomachs are not given, it is impossible to compare the results with those of other examinations. The stomachs were taken from animals killed from June 19 to 23: "June 19 and 22, corn was well up, but the planted kernels were still in condition to invite the gophers. There were few ripe seeds of any kind, so that the stomach contents were generally classified into insects, corn, and 'green stuff,' the last being apparently grass and other plants, a mixture difficult to analyze and not of great importance from our standpoint. The corn was readily distinguishable, while the insects were usually represented by legs, antennæ, elytra, and other hard parts, more or less fragmentary. In the case of cutworms and other larvæ, the whole or a large piece of the skin was generally found, the soft parts having been crushed out. It was not possible, as a general thing, to make out the species of the insect, but the genus or family is sufficient to indicate pretty well whether the species is injurious or not.

"Nos. 1 to 7 were killed on the afternoon of June 19 between 1:15 and 4:30.

"*No. 1.*—In the road near the corner of pasture. Only grass and small grain in the immediate vicinity. Stomach quite full, mostly grain, a little green stuff, and remains of at least one beetle (probably carabid). Another gopher near this one was observed to pick grain out of horse manure in the road.

"*No. 2.*—Near No. 1. Stomach not very full; grain and grass; one beetle (*Chrysomela*).

"*No. 3.*—Near a little stream. Tall grass and weeds all around. A young gopher, two-thirds grown; stomach half full of green stuff; remains of one beetle (*Harpalus?*).

"*No. 4.*—By an old straw stack; weeds, potatoes, and pasture near by. Stomach very full, mostly grain and seeds; about one-third beetles (carabid, and perhaps chrysomelid).

"*No. 5.*—Also killed by the straw stack; stomach full; more grass than No. 4; one beetle (carabid).

"*No. 6.*—Same place; stomach full, mostly green stuff; several beetles, three pieces of skin of lepidopterous larvæ, of which two seemed to be cutworms.

"*No. 7.*—Same place; stomach full; grain, grass, one cricket, two beetles (chrysomelid and carabid).

"The next four gophers were killed June 22, between 9.15 a. m. and 1 p. m.

"*No. 8.*—At edge of grass plat, 10 rods from cornfield. Cheeks full of corn. Stomach full, two-thirds corn, rest insects; one beetle, one cricket (?), about six cutworms.

"*No. 9.*—At edge of creek. Stomach nearly empty; one lepidopterous larva, not a cutworm; one or two beetles (*Chrysomela*); the rest vegetable.

"*No. 10.*—Same place (40 rods from cornfield). Stomach moderately full of corn; one beetle (carabid?).

"*No. 11.*—Same place. Stomach full; mostly insects, numerous beetles (carabid and chrysomelid), one grasshopper, one larva, not cutworm.

"The remaining four were killed June 23, about noon.

"*No. 12.*—At edge of timothy field, near millet, 30 rods from corn. Stomach moderately full, half corn, a little grass, about four cutworms, two or three chrysomelid and as many carabid beetles, one grasshopper.

"*No. 13.*—On campus, grass all around. Stomach moderately full; one-third grass, the rest insects. About eight lepidopterous larvæ, of which one or more were cutworms.

"*No. 14.*—In raspberry patch. Stomach full, mostly corn and grain; one grasshopper; three cutworms; one carabid beetle.

"*No. 15.*—In road not a great distance from cornfield. Stomach full; half full, corn; one beetle; three or four lepidopterous larvæ, of which two were cutworms.

"Summing up the insects, we have nineteen or twenty cutworms, eleven other lepidopterous larvæ, three grasshoppers, and two crickets.

all of which may be set down as injurious. The number of beetles of all kinds could not be definitely ascertained, but was thirty to thirty-five. None of them were species which are noted either for benefiting or injuring the farmer. Those marked carabid and *Harpalus* belong to a family that are generally beneficial, while those marked chrysomelid and *Chrysomela* belong to the leaf-eaters, of which group many species are injurious. As the beetles found in the gophers' stomachs were of both classes, there is no great preponderance on either side" (pp. 9–11).

Undoubtedly the good which the Striped Spermophiles do by destroying insects, and seeds of noxious weeds is of no small importance, but it is doubtful if it is sufficient to offset the damage perpetrated by them in grain fields. In many localities it is impossible to raise a full field of corn without first killing the spermophiles. As soon as the corn is planted they begin to dig up the seed, but do most mischief after the corn begins to come up and until a week or ten days old, or until all the nutriment is drawn from the grain. They dig down by the side of the stalk and eat the swollen, starchy grain, of which they seem very fond, leaving the stalks to die. As a single spermophile will dig up many hills of corn in a day and continue digging for nearly two weeks, it is not difficult to see that serious damage is done where they are numerous, averaging as they often do four or five to an acre. Large fields of corn are sometimes entirely destroyed by them and have to be planted over several times. A great deal of wheat, oats, barley, and rye is taken in the same way, making it necessary to sow an extra amount of seed. Even this means is not effectual, and frequently fields of sowed grain suffer materially from their attacks. As the small grains begin to fill soon after blossoming the spermophiles cut down the stalks and eat the ovules, and in order to find the best heads they cut down a great deal more than they eat. As the grain becomes hard they carry large stores of it into their burrows to be eaten at leisure, probably when they awake from their winter's sleep. The amount of damage done depends upon the abundance of the animals, and is often serious. If a field is small and isolated the spermophiles sometimes collect and destroy almost the whole crop.

Dr. A. K. Fisher in notes on this species and Franklin's Spermophile says: "Where abundant, as they are in many parts of the West, they destroy large quantities of corn, wheat, oats, and the seeds of flax. They also feed to some extent on the seeds of wild plants, even when grain is plenty. A Striped Gopher shot at Heron Lake [Minn.], near a field of wheat stubble had its pouches full of the seeds of the ragweed (*Ambrosia artemisiæfolia*). "In view of the fat that large numbers of these animals are shot and handled it is surprising that they are not used as an article of food. Their flesh is as sweet and delicate as that of the arboreal squirrels, which are held in high esteem as a game dish in many parts of the East. The farmers agree that they ought to be good to eat, but it was impossible to learn of any one who had tried them." (Annual Report Dept. Agriculture, 1887, pp. 455–456.)

In studying the food of the Striped Spermophile eighty stomachs and eleven cheek pouches were collected and their contents carefully examined. Since the stomachs were taken from specimens collected at various dates, ranging from May 19 to August 31, and over an extent of country including Minnesota, the Dakotas, Montana, Wyoming, Kansas, and Texas, it may be reasonably inferred that the average summer diet of the species is represented. Following is a list of the food components found in the stomachs:

ANIMAL.

- Grasshoppers.
- Crickets.
- Caterpillars (larvæ of Lepidoptera).
- Beetles.
- Ants.
- A small cocoon.
- Insects' eggs.
- Spermophile hairs.
- Feathers of small birds.

VEGETABLE.

- Oats.
- Wheat.
- Pig-weed (*Chenopodium*).
- Bind-weed seeds (*Polygonum*).
- Wild sunflower seeds (*Helianthus*).
- Nightshade berries (*Solanum*).
- Cactus fruit (*Opuntia*).
- Roots.
- Herbage.

The number of feathers was not sufficient to prove that birds had been eaten. The spermophiles may have picked up stray feathers to line their nests with and in carrying them home accidentally swallowed a few. Still, from their well-known carnivorous habits, it seems most probable that wounded or dead birds had been found and eaten. Most of the hairs in the stomachs seemed to have come from the animals themselves and were probably swallowed by accident.

Summary.—Of the total contents of the eighty stomachs examined, more than half consisted of insects. The percentage of animal matter was 52.9; of vegetable matter 44.4; and of indeterminate matter 2.7. The cheek pouches contained 100 per cent of vegetable matter, being filled exclusively with grain and seeds of various plants.

Table showing contents of 80 stomachs of the Striped Prairie Spermophile (Spermophilus tridecemlineatus).

Cat. No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
		1887.				
13	♀	May 19	Heron Lake, Minn	3	97	Small insects; shell of little striped beetle; oats, seeds, herbage.
14	♂	May 19	do	10	90	Beetles; chewed vegetable fiber; pulp, and shells of seeds.
15	♂	May 19	do	25	75	Beetles; one small striped beetle; vegetable matter, and seeds.
16	♂	May 21	do	70	30	A beetle; a coleopterous larva; other insects; vegetable matter.
17	♀	May 21	do	100		Insects.
18	♀	May 21	do	100		Crickets; larvæ, apparently of bumblebees.

Table showing contents of 80 stomachs of the Striped Prairie Spermophile (Spermophilus tridecemlineatus)—Continued.

Cat. No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
19	♂	1887. May 27	Flandreau, S. Dak	30	70	Beetles and other insects; seed pulp, and hulls.
20	♂	May 27	do	30	70	About 18 coleopterous larvæ; grain; herbage.
21	♀	May 27	do	25	75	Some small cocoons; seed shells.
53	......	June 9	Ortonville, Minn	80	20	Beetles; grasshoppers; caterpillars; vegetable matter.
55	......	June 9	do	50	50	Coleopterous and other larvæ; grain; vegetable matter.
62	♂	June 11	do	25	....	Particles of insects; dirt.
81	♀	June 24	Browns Valley, Minn.	75	25	Grasshoppers; trace of beetles; some remains of grain.
84	♂	June 27	do	5	95	A few bits of ants and other insects; herbage, and grain shells.
100	♀	June 30	do	40	60	Grasshoppers; beetles; larvæ; insect eggs; seeds; herbage.
103	♀	July 1	do	10	90	Grasshoppers; beetles; ground-up seeds.
109	♂	July 2	Travare, S. Dak	20	80	Pieces of 3 larvæ of insects; grasshoppers, and grain.
112	♂	July 4	do	2	98	Grasshopper; vegetable fiber, and seed pulp.
115	♀	July 5	do	30	70	Beetles; grasshoppers; grain; herbage.
116	♂	July 5	do	50	50	Beetles; grasshoppers; shells and pulp of seeds.
125	♂	July 7	do	50	50	Grasshoppers; caterpillars; trace of beetle; bark or roots.
126	♀	July 7	Browns Valley, Minn.	25	75	Grasshoppers; beetles; seeds of *Polygonum.*
127	♂	July 8	Travare, S. Dak	30	70	Grasshoppers; crickets; other insects; grain; roots.
139	♂	July 18	Grand Forks, N. Dak.	....	100	A little finely chewed wheat or oats.
143	♀	July 18	do	....	100	A few bits of oat hulls and skin of grains.
144	♂	July 18	do	50	50	Bits of small insects and seeds.
145	♂	July 18	do	4	96	1 grasshopper; oats.
149	♀	July 22	Pembina, N. Dak	100	....	Insects, mostly grasshoppers.
152	♂	July 23	do	60	40	Grasshoppers; wheat.
162	♂	July 25	do	25	75	Insects; wheat.
163	♀	July 26	do	50	50	Grasshoppers; finely chewed seeds.
170	♂	July 26	do	90	10	Grasshoppers; a little grain.
179	♀	July 28	do	3	....	Hair of *Spermophilus tridecemlineatus* and some indeterminate matter.
185	♂	July 28	do	100	....	Insects; ants; small beetles; pupæ of ants(?).
186	♀	July 28	do	100	....	Insects only; mostly grasshoppers.
194	♂	July 30	do	80	20	Mostly grasshoppers; some vegetable matter.
203	♂	Aug. 2	do	100	....	Insects, mostly grasshoppers.
206	♀	Aug. 8	Devils Lake, N. Dak	100	....	Crickets; small beetles; grasshoppers.
207	♂	Aug. 10	do	2	98	Insects; wheat; some small seeds.
211	♀	Aug. 12	do	75	25	Mostly grasshoppers; grain; herbage.
212	♀	Aug. 12	do	95	5	Insects; grasshoppers; ants; herbage.
216	♂	Aug. 13	do	50	50	Grasshoppers; hair; grain; herbage.
221	♀	Aug. 15	do	100	....	Insects, mostly grasshoppers.
224	♀	Aug. 16	do	50	50	Grasshoppers; other insects, grain; herbage; *Solanum* seeds and berries.
232	♀	Aug. 23	Bottineau, N. Dak	90	10	Insects; grasshoppers; ants; small beetles; larvæ; 1 feather; hairs; vegetable matter.
242	♀	Aug. 24	do	100	....	Grasshoppers.
259	♂	Aug. 29	do	50	50	A few insects; hairs; indeterminate vegetable matter.
265	♂	Sept. 6	Fort Buford, N. Dak	80	20	Mostly grasshoppers; seeds of *Helianthus* and *Chenopodium.*

Table showing contents of 80 stomachs of the Striped Prairie Spermophile (Spermophilus tridecemlineatus)—Continued.

Cat. No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
		1887.				
266	♂	Sept. 6	Fort Buford, N. Dak	40	50	Insects; green herbage; 10% indeterminate matter.
284	♂	Sept. 14	do	90	10	Mostly grasshoppers; a few *Helianthus* seeds.
289	♀	Sept. 16	do	25	75	Grasshoppers; green foliage; *Helianthus* seeds.
304	♂	Oct. 5	Dawson County, Mont.	50	50	Grasshoppers; seeds of *Helianthus* and of probably *Mammilaria*.
		1888.				
377	♀	May 21	Pierre, S. Dak	50	50	Grasshoppers; wheat.
378	♀	May 21	do	10	90	Insects; seeds; herbage.
379	♂	May 23	do	20	80	Grasshoppers; grain; herbage.
386	♂	May 25	do	20	80	Grasshoppers; *Polygonum* seeds.
419	♂	June 28	Buffalo Gap, S. Dak	100	....	Grasshoppers; perhaps other insects; 1 small feather.
429	......	July 3	do	95	5	Insects; crickets; 4 species of beetles; vegetable matter.
444	♀	July 16	Custer, S. Dak	50	50	Grasshoppers; other insects; seeds; other vegetable matter.
477	♀	Aug. 20	Cheyenne, Wyo	25	75	A few grasshoppers; 1 black beetle; *Chenopodium* seeds; green stuff.
481	♀	Aug. 21	do	25	75	Grasshoppers; 1 larva or pupa; indeterminate herbage and seeds.
482	......	Aug. 21	do	50	50	1 ant; 1 small beetle; grasshoppers; *Chenopodium* remains; other plants and seeds.
		1892.				
	♀ im.	July 12	Golden City, Mo	20	80	Wheat and small beetles.
	♀ im.	July 12	do	30	70	A grasshopper; flowers and herbage.
	♂ im.	July 12	do	40	60	A grasshopper and wheat.
	♀	July 26	Belle Plaine, Kans	100	....	1 large grasshopper and its eggs.
	♀	Aug. 2	Garden Plain, Kans	75	25	Grasshoppers; beetles; wheat.
	♂	Aug. 16	Wichita Falls, Kans	75	25	Grasshoppers and seeds.
	♀	Aug. 17	do	80	20	Grasshoppers; 1 cricket; purslane leaves.
3867	♂	Aug. 23	Washburn, Tex	100	....	Do.
3868	♂	Aug. 23	do	50	50	Grasshoppers and oatmeal (used for trap bait).
2869	♂	Aug. 23	do	90	10	Do.
3871	♀	Aug. 23	do	100	....	Grasshoppers.
3872	♂	Aug. 23	do	60	40	Grasshoppers and cactus fruit.
3895	♂	Aug. 31	Kiowa, Kans	40	60	Insects and seeds.
3896	♀	Aug. 31	do	50	50	Grasshoppers; small insects and seeds.
3897	♀	Aug. 31	do	20	80	Small insects and seeds.
3898	♀	Aug. 31	do	100	....	Grasshoppers.
3899	♀	Aug. 31	do	50	50	Grasshoppers; other insects, and seeds.
	♂	Aug. 31	do	80	20	Grasshoppers; small beetles; larvæ of insects; seeds.

The following tables show that the contents of the cheek pouches differ widely from those of the stomachs, many things being eaten that are never stowed away in the pouches. For instance, more than half of the stomach contents consisted of insects, while no insects were found in the cheek pouches, the latter invariably containing nothing but seeds. This is what might be expected, as the food laid up for winter is carried in the cheek pouches.

Table showing contents of cheek pouches of 11 Striped Prairie Spermophiles (Spermophilus tridecemlineatus).

Cat. No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
84	♂	1887. May 27	Browns Valley, Minn.	....	100	43 grains of wheat; 400 seeds of millet; 2 seeds of *Stipa spartea;* 1 seed of Polygonum.
100	♀	May 30	......do	....	100	Seeds of *Lithospermum.*
137	♀	June 14	Harwood, N. Dak	....	100	71 grains of oats.
145	♂	June 18	Grand Forks, N. Dak	....	100	31 grains of oats.
265	♂	Sept. 6	Fort Buford, N. Dak	....	100	127 seeds of *Helianthus.*
424	♂	1888. July 3	Buffalo Gap, S. Dak	....	100	Seeds of a *Stipa.*
	......	1890. Oct. —	Fort Snelling, Minn	....	100	1,388 seeds of bindweed; 30 seeds of pigeon grass; 4 seeds of panic-grass (coll. by Dr. E. A. Mearns).
	......	....	......do	....	100	1,075 seeds of ragweed; 95 seeds of bindweed; 110 seeds of panic-grass (coll. by Dr. E. A. Mearns).
2	♂	1889. May 19	Graham County, Kans	....	100	163 seeds of black locust.
3872	♂	1892. Aug. 23	Washburn, Tex	....	100	Seeds of prickly pear (*Opuntia r. cymochila*).
	♂	Aug. 31	Kiowa, Kans	....	100	Wild peas (*Hosackia purshiana*).

MEXICAN SPERMOPHILE.

Spermophilus mexicanus (Licht.).

[Map 3, B.]

Description.—This species resembles *Spermophilus tridecemlineatus.* The ears project but slightly from head, and the tail is long and quite bushy. The sides and legs are buff; the belly and throat whitish; the back light brown with usually nine or eleven rows of white or buff spots, no solid buff stripes, but the spots are arranged in rows extending from head to tail along middle of back and become shorter laterally; the dorsal stripe is indistinct.*

The following measurements are those of an average-sized specimen selected from twelve adults: Total length from nose to tip of tail vertebræ, 308 millimeters (12¼ inches); length of tail vertebræ, 128 millimeters (5 inches); length of hind foot from point of heel to point of longest claw, 42 millimeters (1⅝ inches).

Range.—This Mexican species enters the United States only in southwestern Texas and southern New Mexico, extending thence over the table-land of Mexico to Zapotlan, Jalisco, and as far south as the Valley of Mexico and Orizaba.

The area shown on the map gives an idea of only about half of its distribution. It is known to occur in at least nine states of Mexico—Coahuila, Guadalajara, Guanajuato, Hidalgo, Mexico, Nuevo Leon, Puebla, Tamaulipas, and Vera Cruz. Its range apparently extends across the table-land of Mexico from Mt. Orizaba nearly to the volcano of Colima, and from the Valley of Mexico to the mouth of the Rio Grande, and thence northwestward to El Paso. As yet only a few outlying points have been determined and much data is needed to determine accurately the eastern and western limits of its range. In the United States its range covers the southwestern third of the State of Texas, extending as far north as Mason, Stanton and Colorado, while it follows up the Pecos Valley as far as Eddy, New Mexico.

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* This spermophile is distinguished from the two species of United States spermophiles, which it most nearly resembles and with which it comes in contact, as follows: From *S. tridecemlineatus* by the absence of solid lines of buff alternating with the rows of spots, and from *S. spilosoma* by the spots being arranged in rows instead of scattered irregularly over the back.

Habits.—I have met with it in but one locality, Del Rio, Tex., where it was living on low, brushy land and among mesquites. At that season (February), it seemed to keep very quiet as though in a state of semi-hibernation, and was rarely seen. I found a hole with the entrance carefully packed full of dirt, evidently filled from within. A careful search failed to discover any other opening to the burrow, so I removed the dirt and set a small steel trap in the hole a few inches from the entrance. The next day the trap contained a spermophile caught in such manner as to indicate that the animal had been taken while attempting to leave its hole. It was dead, with its head in the trap and the body back in the hole. I was much puzzled at the time that a spermophile should close the entrance to its burrow after the manner of the pocket gophers, kangaroo rats, and pocket mice, but Mr. Wm. Lloyd has since mentioned the same habit in writing of the species at Mier, Mexico. He says: "They are common about here, and make numerous burrows in the little hillocks at the foot of shrubbery. The main hole can always be distinguished, as it is invariably covered up. Their burrows extend for a considerable distance, about 10 inches or a foot, under ground. One that gave way beneath my feet I opened up for 2 yards each way and there was no hole near. I hoped that I was on the track of a mole, but a trap in each section of the tunnel gave me the occupant, a spermophile."

At another locality Mr. Lloyd states that their holes were not covered, but it seems that this species does sometimes at least close the entrance to their burrows, contrary to the traditions of spermophiles in general. The same habit has been reported in the case of Franklin's Spermophile, where introduced in New Jersey, though I never knew of their practicing it in their native haunts.

I have never heard the voice of *Spermophilus mexicanus*, nor can I find any reference to it. Their habits seem to be little known. Mr. B. H. Dutcher found these spermophiles at Stanton and Colorado, Tex., and at Eddy, N. Mex. He says: "It is somewhat difficult to observe the habits of this species while on foot, as it is shy, and is hidden by the grass from an observer. Those that I saw running seemed to move both fore feet at once, and both hind feet at once, thus moving in what might technically be called a gallop. Considerable speed is attained, and their motions are in no way sluggish as are those of the prairie dog. I saw none at rest, but the family with whom I lived at Colorado had formerly had one as a pet, and they frequently described to me how this individual used to stand on his hind feet. From this, and also from analogy, I infer that an upright position is a common one in nature."

"Both at Colorado and at Stanton this species was trapped with greatest success at the roots of mesquite trees, where the spermophiles seem to prefer to dig their burrows. The holes were not uniformly regular in outline, but invariably seemed to descend at an angle and not vertically.

"At Eddy, N. Mex., the species was fairly common, inhabiting the stony or shingly land. I did not find it at all in the sand, except at the edges, where the sand met the shingle. On the lower staked plain, or on what may be termed the 'large-mesquite plain,' they did not seem to inhabit the sandy land or 'shinn'ry,' but rather confined themselves to the hard red soil and mesquite groves."

Mr. E. W. Nelson has observed this species in Mexico, and says: "It is found about the borders of the Valley of Mexico [near Tlalpam], but is restricted in its distribution. It is only found in loose and rather sandy soil, in fields and along the banks of arroyos, near the border of the valley bottom. * * * It is not uncommon in the grain fields about Irolo, Hidalgo. One was found sunning itself early one morning beside a clod of earth in a field. It remained so quiet at our approach that my assistant and myself stopped within eight or ten feet of it and discussed the question whether it might not have one of our small traps on its feet. To make sure, I took a small piece of hard clay and approached within almost arm's length to strike it, when it darted off across the field with all possible speed, and was only secured by a quick shot. As a rule, these animals are very shy, and make for their holes long before one gets within gunshot. They are so vigilant and quick to take alarm that but few are seen, even when comparatively common.

FRANKLIN'S SPERMOPHILE.

Spermophilus franklini (Sabine).

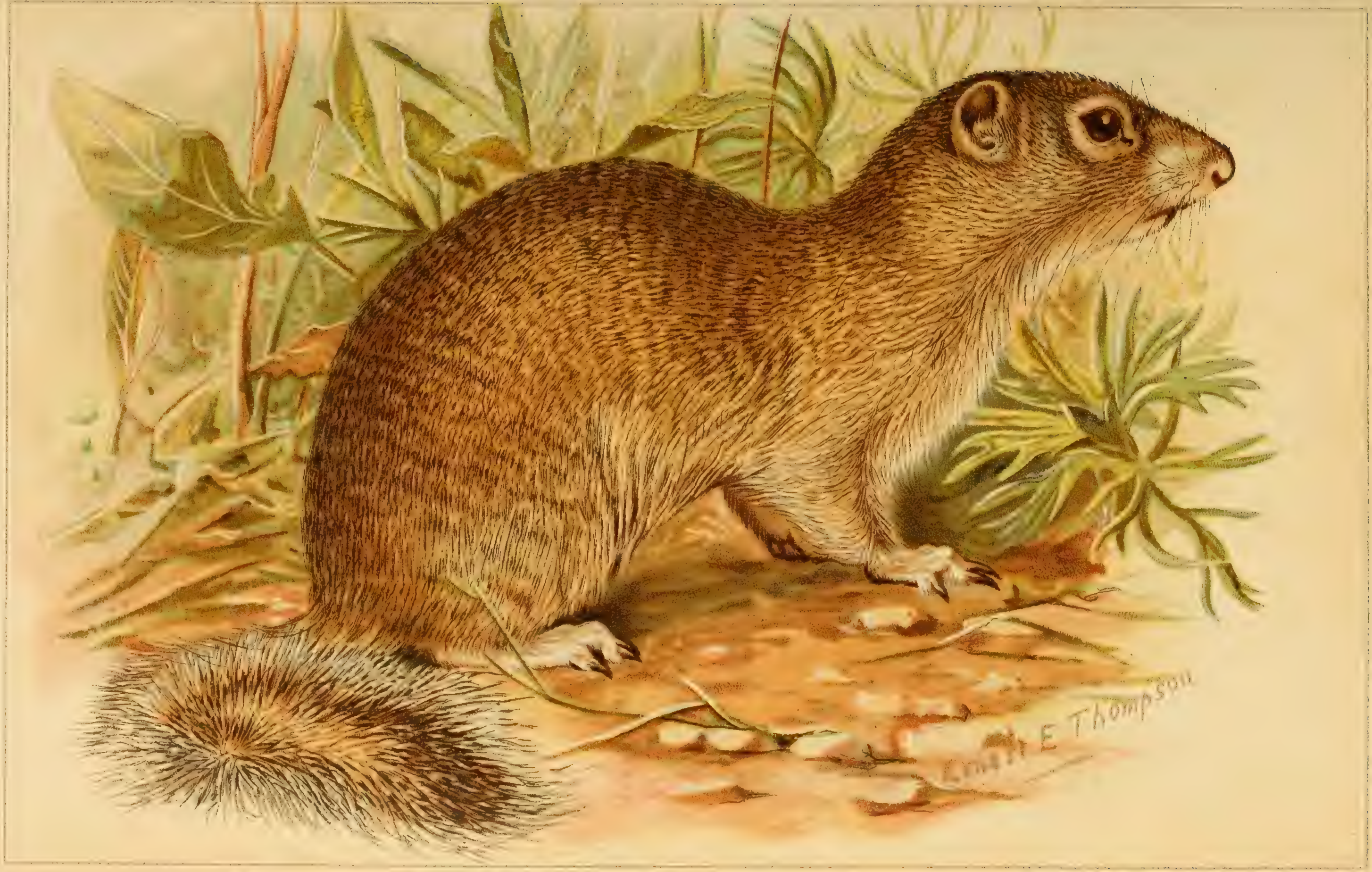
[Plate II—Map 2.]

Description.—This spermophile has somewhat the appearamce of a small gray squirrel, but has ears less than half as long and a smaller tail. The hair is coarse and harsh. In color, it is gray, lighter on the belly, becoming whitish on the throat; the back is suffused with tawny or yellowish brown, and marked with fine wavy cross lines of black; the head and tail are usually clear gray.

The measurements of an average-sized specimen selected from ten adults are as follows: Total length, from end of nose to end of tail vertebræ, 378 millimeters (14⅞ inches); length of tail from angle with back to tip of vertebræ, 139 millimeters (5½ inches). Length of hind foot from point of heel to tip of longest claw, 52 millimeters (2 inches).

Franklin's Spermophile is locally known under the names of Gray Ground Squirrel, Gray Gopher, Scrub Gropher, Prairie Squirrel, and Gray-cheeked Spermophile. Any one of these is distinctive enough where the animal is found, but beyond its range the terms Gray Ground Squirrel and Gray Gopher apply just as well to nearly a half a dozen species of somewhat similar animals found in the Rocky Mountain and

PLATE II.


Ernest E Thompson

Trautmann, Bailey & Blampey N.Y.

FRANKLIN'S SPERMOPHILE. SPERMOPHILUS FRANKLINII (Sabine).

Pacific coast regions.* The name Prairie Squirrel, while serving to distinguish it from the arboreal squirrels, does not distinguish it from the other species of prairie squirrels. Gopher, both from general use and origin of the name, should be restricted to the pocket gophers (*Geomys* and *Thomomys*). Let us drop all but Franklin's Spermophile, which can be confounded with the name of no other animal.

When numerous it is an exceedingly troublesome animal, destroying much grain both by digging up the seed and by cutting and tangling down the ripe grain, and occasionally feasting on small chickens from the poultry yard. At the same time, it eats vast numbers of insects of the species particularly injurious to crops, and in this way the good it accomplishes may exceed the loss sustained from its depredations. An examination of the contents of twenty-nine stomachs shows something of the character of the food selected and is decidedly favorable evidence of the animal's usefulness. If by any means its depredations can be prevented without destroying the animals it becomes the most useful protector of farm products. Various means for preventing their attacks on sprouting grain have been employed with some degree of success. Others more effectual may yet be devised.

Range.—The species was first described by Sabine in 1822 from specimens collected at Carlton House on the Saskatchewan River in Manitoba. From this point it ranges south over the Red River and Mississippi valleys to central Missouri and southern Kansas, inhabiting the prairie region from its eastern edge along the line of heavy timber westward to central Kansas and the Dakotas. Its eastern limit corresponds closely with that of the Striped Spermophile, but does not reach Michigan, nor extend as far south as the range of that species. The boundary of its distribution in Minnesota may be indicated by a line drawn from the northwest corner of the State to St. Paul. In Wisconsin the northernmost records come from Plover and Ripon, where it is rare; only two records have been received from Indiana—Kentland and Earl Park—both near the western boundary of the State. Its southern limit is indicated by Bement and O'Fallon Depot, Ill.; Sedalia, Mo., where it was said to occur formerly; and Erie and Kellogg, in southeastern Kansas.

Franklin's Spermophile ranges west to Belvidere and Kearney in southern Nebraska, and in the Dakotas is not known to pass west of the Missouri River, except at Willow Creek a few miles west of Pierre, S. Dak. Its western limit corresponds closely with the eastern limit of the prairie dog (*Cynomys ludovicianus*), the one occupying the moist and fertile eastern prairies, the other the more arid western plains.

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*Within its range (as shown on the map), there is no animal closely resembling it or that need be mistaken for it by even a careless observer. The Rock Squirrel (*Spermophilus grammurus*) of the Rocky Mountains and foothills has somewhat the same general appearance, but when full grown is much larger, with longer tail and ears.

At Elk River, Minn., where I first made their acquaintance in the spring of 1872, they were rather scarce, though on a farm with the best of opportunities for observing them, usually not more than six or eight were seen during a summer for the succeeding fourteen years of my residence in this place. As they were not sufficiently common to do much damage, they were rarely killed, and their numbers seemed never to change appreciably. This locality is at the extreme eastern limit of their range in that latitude. A little further west they are much more common, and seem to reach the maximum abundance along the valleys of Minnesota and Red rivers.

Introduction into New Jersey.—A widely isolated colony of these spermophiles exists in eastern New Jersey, in the region about Tuckerton, where a single pair, brought from Illinois, escaped from their cage in 1867. Concerning the origin of this colony, Dr. J. A. Allen has written briefly as follows:

"I learned of its introduction there through Mr. Samuel Jillson, who first wrote me about it some three or four years since. Writing him recently for further information respecting the date and manner of its introduction, as well as for information respecting its present numbers and the area of its range, he has kindly replied as follows, under date of 'Tuckerton, New Jersey, May 6, 1877':—'The date of its introduction is May, 1867, when a single pair was brought here by Mr. Sylvester Mathis, from Illinois. This pair soon gnawed out of their cage and escaped. This was in the village of Tuckerton. They are now found in Minahawken, 9 miles north of Tuckerton, and also 4 miles south of Tuckerton, and very likely farther. They are very common on all the farms about here, 3 miles from the village' [of Tuckerton]." (Monographs N. Am. Rodentia, 1877, p. 883.)

In June last year Mr. E. A. Preble, of the Division of Ornithology and Mammalogy, visited Tuckerton, N. J., for the express purpose of ascertaining whether this introduced colony was increasing and whether their depredations were of a serious nature. In his report he says: "They are known to the inhabitants as the 'Prairie Squirrel' in contradistinction from the gray timber squirrel native to the region. Instead of increasing in the vicinity of Tuckerton their numbers have diminished of late years from the constant war waged against them by men, boys, and dogs. Still their range is steadily widening, and they are now common over much of the southern portion of the State. They have spread westward almost across the state to Auburn, Salem County, near the Delaware River, and northward at least as far as Red Lion, in Burlington County. The sandy uplands seem to furnish a congenial soil in which to make their burrows, which are usually placed in brushy fence corners along fields and roads or occasionally out in open fields. True to their native instincts they do not enter the more thickly timbered regions, but keep to the naturally open land or cleared fields, pastures, and roadsides.

"They are destructive to a number of crops, but particularly to corn, which they dig up after it is first planted in the spring. When the animals are numerous this frequently necessitates replanting and constant watching of the corn by the farmer who wishes to secure a crop. They also destroy a considerable quantity of corn as it stands in the shock in the fall and are said to eat peas and various grains. It is claimed that they frequently kill young chickens and ducks, though I was unable to procure definite data on the subject. It is probable that a few such cases have been freely reported and are less common than is generally believed."

Habits.—Franklin's Spermophile is characteristic of prairies and open country, is never found in heavy timber, and does not climb trees. The places usually selected for their holes are among tall grass, weeds, and scattered brush. Often they are found living along the edge of timber that adjoins the prairie or in small groves. At Devils Lake, N. Dak., they were most common in the straggling groves of small trees a little back from the lake, and many of their burrows were placed under logs and stumps or between the roots of trees.

They frequently take up their abode near buildings, especially about barns and sheds, and in many cases prove troublesome neighbors. In the summer of 1887 I found them numerous at Browns Valley, on the western boundary of Minnesota, especially among the buildings along the edge of town. Some had holes under houses which were occupied, and I saw one sitting up within 15 feet of an open door. A lot of manure had been hauled out of town and piled on some waste land beyond the city limits, and quite a colony had collected around it. They were digging in the manure and seemed to find some kind of food in it.

In but few places are they as common as the smaller Striped Spermophile (*S. tridecemlineatus*), though the two species range together over a wide area. Their habits are quite similar and it is often difficult to distinguish the voice of one from that of the other The note of Franklin's Spermophile is somewhat heavier and has a slightly different ring, but it is the same shrill, rapid chipper or trill. It is sharp and ringing and may be heard for a considerable distance.

Like all spermophiles they are frequently seen standing up on their hind feet, straight and motionless. After watching several of them quietly feeding for a time, I have attracted their attention by a slight noise in order to see them rise quickly to an erect position. They seem to stand as firmly on two feet as a person. Usually they run low and go scudding through the grass, but if badly frightened will take long high leaps, precisely like a gray squirrel.

Appearance in spring.—In autumn Franklin's Spermophiles become excessively fat and with the first cold weather disappear into their holes and do not come out again until the following spring. The date of their reappearance depends on the season as well as on the latitude of the place, but in the States along our northern boundary it is usually in the latter part of April. In North Dakota Mr. Evelon Brown reports them as first seen at Bathgate, in the spring of 1889, on April 3, and in 1890 on April 21. In Minnesota Dr. Thomas S. Roberts reports their first appearance at Minneapolis on April 30, 1877, and April 23, 1878, while Mr. Plummer L. Ong noted their first appearance at Hennepin, Putnam County, Ill., in the second week of April in 1884. Like other hibernating animals, they usually come out 'spring poor.' If the stores of grain are not eaten during winter, they probably are during spring when other food is scarce.

The young are evidently born some time in May or June, as by the 1st of August half-grown animals are out of the holes hunting food for themselves. One female examined contained six embryos, which is probably the usual number of young in a litter.

Why this spermophile should not be considered fit for food is a mystery, of which the only explanation seems to be an unreasonable and almost universal prejudice against eating burrowing animals. I can not speak from experience, but others who have eaten them say that they are excellent, and other species of the same genus that I have eaten are equal to the best of the tree squirrels. Anyone who will study their habits carefully will find no reason why they should not be a staple article of food. The holes in which they live are as clean as the home of any squirrel; new holes are dug each year or the old ones extended into fresh soil. New nests of grass and soft plants are provided in autumn, and no dirt of any kind is allowed to remain in the holes. Nor is there anything in their food habits to render them objectionable.

Injury to crops.—The following extracts from letters received by the Division of Ornithology and Mammalogy contain interesting notes on the habits of this species and the damage caused by its depredations:

According to Mr. Lawrence Bruner of Lincoln, Nebr., "Franklin's Spermophile is quite common in some parts and rare in others. It is a pest to farmers. It is carnivorous, at least when in captivity, as I can testify from experience with one I had caged during the greater part of one summer. After having been in the cage for about a month I turned in a mouse, one day, in order to have a 'happy family' in my menagerie. Imagine my horror, then, to see Mr. Squirrel pounce upon the mouse, kill and eat it in such a manner as to indicate that it was not the first mouse thus eaten. The bones were held in the fore feet and stripped clean, after which they were dropped. The time occupied for the entire task of killing and eating the mouse was not more than five minutes."

Prof. L. L. Dyche, of Lawrence, Kans., gives the following account of the species under date of October 12, 1888: "Not much damage is done by this species (at least, not much thus far reported), except in certain localities, and mostly where fields are inclosed by stone walls. The squirrels dig up the corn (and sometimes other seeds) soon after it is planted in the spring and in the fall do some damage by burrowing under corn shocks. They eat some corn and usually carry considerable down in their holes in the ground. On my father's farm, 36 miles west of here, at Auburn, Shawnee County, Kans., they were very common several years ago. They would dig up the corn almost as fast as it was planted for a distance of a few rods in from the stone walls wherever the latter inclosed the fields. On an average I think there could not have been less than one squirrel for each rod of fence. Apparently there was one for each few feet. We killed many of them with guns and tried to poison them, with apparently very little success. By scattering shelled corn along the fences for the squirrels to feed upon while the planted corn was coming up most of the difficulty was obviated. A wary old female cat, which had taken up her quarters in a barn in one of the fields, caught many of the squirrels, and was accustomed to carry them to her kittens when the latter were large enough to feed upon such things. The offspring of this cat, when they were full grown, also preyed upon the squirrels. In the course of a few years these cats, over a dozen in number, almost exterminated the squirrels. They would sit on the stone walls and pounce upon the squirrels when the latter came out from their hiding places. These same cats also caught many rabbits. I do not know of any other instance where cats caught the large ground squirrels to any considerable extent."

From La Moure, N. Dak., Mr. C. B. Struble writes: Franklin's Spermophile is most destructive in dry seasons, when it comes in from the surrounding prairie. The burrows are not confined to the edges of fields, but are found all over them. Summer fallowing removes them by starving them out. They are very destructive to gardens, especially to peas and cabbage; some slight damage is also done by digging up seed in the spring. Poison is the only effective remedy against them. County commissioners distribute poison free of expense to all farmers applying for it."

At Ripon, Fond du Lac County, Wis., where this species is rare, Prof. W. W. Cooke considers that it does no harm. He says: "At Ripon the Striped Gopher does damage, but the Gray Gopher does none. The Gray Gopher is very scarce there. I have not seen a dozen specimens in more than as many years' residence in that vicinity, whereas at White Earth, Minn., they were abundant and did an immense amount of damage."

We are informed by Prof. C. B. Waldron, arboriculturist of the North Dakota Agricultural College and Experiment Station, that in eastern North Dakota, where Franklin's Spermophile was formerly abundant, it is now being driven out by Richardson's Spermophile, which is on the increase in this region.

Robert Kennicott says of this species: "They fed upon June grass, clover, timothy, and the broad-leaved plantain, and seemed particularly fond of the leaves of the common mustard, of which some plants grew near their burrows. Other specimens examined in summer had their stomachs filled with grass alone. In eating they sat upright on the tarsi and used their fore feet as hands to draw the leaves to their mouths, though their paws were used thus with less facility than those of the true squirrels. Though both the vegetable and flower garden were situated within 5 rods of their burrows I do not remember that they were observed to injure either. A number of young chickens disappearing, however, and the eggs being eaten in several hens' nests near the burrows of the spermophiles, suspicion rested upon them—probably unjustly—and a war of extermination was commenced. Several were shot, while others were killed with clubs, whereupon the survivors left in a body as suddenly as they had come and were never seen again, nor could they be found upon any part of the farm. I have known this spermophile to take refuge in a hollow tree, crowding up the hole like a gray rabbit. Mr. F. C. Sherman, of Chicago, informs me that he twice saw one, when pursued, climb 5 or 6 feet up the trellis work and vines at the side of a house.

"The burrow of this species is usually deeper than that of the Striped Spermophile, but otherwise similar to it. The young I have not observed, but Mr. George S. Parker, of Pecatonica, Ill., writes me that he once saw five and at another time seven young in a nest. They appear to go into winter quarters in the fall and reappear in the spring at about the same time as the Striped Spermophile. They have been found hibernating under piles of rails and in corn shocks, and I am informed of two instances in which one has been found torpid in a haystack, where he had formed a burrow in the hay. I have never heard of its hibernating in such situations. A caged specimen of Franklin's Spermophile, kept by Prof. Baird, of the Smithsonian Institution, was active all winter; and Dr. A. M. D. Hughes, of Payson, Ill., informs me that he found one in a burrow under a corn shock, active in mild weather late in November.

"This species is carnivorous, though apparently less so than the Striped Spermophile. A specimen kept by Prof. Baird was decidedly carnivorous, but one observed by Dr. Hoy did not eat mice, though it killed them when placed in the cage. Its food is generally similar to that of the Striped Spermophile, stores being also found in its burrow. It gnaws hard substances more than the Striped Spermophile, and, while the latter will not gnaw out of a box, this readily does so. Caged specimens cut open hazelnuts also.

"This squirrel injures the farmer by taking up newly planted corn,as does the Striped Spermophile. Being far less abundant than the other, however, it is usually less complained of on newly broken land; but it is sometimes the more injurious of the two on old farms, where it burrows in cultivated fields more willingly than the other. It frequently burrows during summer in grain fields, where it eats the green plants, and afterwards the heads of grain as the kernels fill; and in this manner, and by throwing down the standing grain, spoils it for some distance around the burrow. Having a great predilection for burrowing in ditch-banks, and in underdrains filled with brush, it often does serious injury in this way.

"This species may be destroyed in the same manner as the preceding, though they are not so easily drowned out of their holes, especially when they are in a bank or drain. They appear to leave their burrows with less caution, and for a greater distance, than the others; and, being also less active, they are sometimes chased and killed with a stick. They are probably more liable to the attacks of rapacious animals than the others. I have known domestic cats to catch them when full grown.

"It is possible that the Striped Spermophile drives off this species, as the two are not found occupying the same field." (Report Commissioner of Patents for 1856, pp. 80–81.)

FOOD.

A large part of the food of Franklin's Spermophile consists of grain and various seeds. Corn, wheat, oats, and rye are favorite foods, and where the spermophiles are numerous farmers often sustain considerable loss from their depredations, especially from the seed which they dig up after it is planted. The amount of ripe grain eaten and carried to their holes and stored for winter is of less consequence. In fields of small grain, as wheat, barley, and oats, they do not usually cut down the stalks, as do the smaller spermophiles, to get at the grain, but bend them over. In this way they tangle and trample down much more than they eat or carry away. The amount of damage depends on their abundance. Where most numerous it is quite serious. Their fare is extensive and by no means limited to grain or vegetable matter, as shown by the contents of the stomachs examined. Grasshoppers, crickets, beetles, and caterpillers are standard articles of diet, but ants and various other insects are also eaten.

Table showing food found in 29 stomachs of Franklin's Spermophile (Spermophilus franklini).

ANIMAL.

Beetles, large and small species (*Coleoptera*).
Larvæ of beetles (*Coleoptera*).
Caterpillars (larvæ of *Lepidoptera*).
Grasshoppers and crickets (*Orthoptera*).
Ants.
Eggs of insects.
Chrysalis.
Feathers of small bird.
Spermophile hair, probably their own.

VEGETABLE.

Grain (wheat and oats).
Seeds of basswood (*Tilia*).
Strawberries.
Solanum berries.
Herbage, stems and leaves of plants, among which only an *Equisetum* could be recognized.
Roots.

At Pembina, N. Dak., I found several young mice (*Sitomys michiganensis*) in the stomach of one of these spermophiles and at Ortonville, Minn., I shot one in the act of eating a freshly killed wood phœbe (*Contopus virens*). It had evidently just caught the bird, though it is difficult to understand how. Speaking of the omnivorous habits of the species Prof. C. L. Herrick says: "During the summer it feeds upon wild fruits, such as strawberries, but has well-marked carnivorous propensities. During a few days' encampment on Lake Traverse, several of these animals became so domestic as to partake freely of fish from our table so long as no suspiciously hasty motions were executed by the human participants." (Mammals of Minn., 1893, p. 167.)

Mr. David H. Henman, of Willows, N. Dak., reports that Franklin's Spermophile kills small chickens, and similar complaints have been made of the small colony introduced into New Jersey. "Mr. Jillson writes under date of May 18, 1885: 'They are not numerous enough yet to do a great deal of damage to crops, but if a pair takes up its abode near small chickens or turkeys they soon thin them out'" (Herrick, *loc. cit.*, p. 168). At Browns Valley, Minn., they were said to have killed five chickens that were feathered out and as large as quails. The woman who told me about it saw a spermophile catch and kill one of the chickens. Others have reported cases where they were strongly suspected of killing young chickens, and, from their decidedly carnivorous tastes, there is no reason to doubt that the blame was correctly placed.

For the purpose of ascertaining the food of this species with greater precision than is possible by general observations, twenty-nine stomachs were collected, and the contents examined in the laboratory. In most cases the stomach contents were well masticated and so thoroughly mixed that no system for accurately measuring the proportion of the different substances could be applied. Small seeds were often found unbroken, and wheat, oats, barley, and other large seeds could usually be recognized by the shells and harder parts that remained. Grasshoppers and crickets were easily recognized by the legs, wings, jaws, and other tough parts, while the skins of caterpillars often remained entire and served to show the order, if not the genus, to which they belonged. A great many small insects were so finely chewed that nothing remained to show what they were.

Summary of the contents of twenty-nine stomachs.—Animal matter, 30.3 per cent.; vegetable, 68.5; matter not positively determined as to whether animal or vegetable, 1.2.

Table showing contents of 29 stomachs of Franklin's Spermophile (Spermophilus franklini).

Cat. No.	Sex.	Date	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
11	♂	1887 May 17	Heron Lake, Minn	10	90	A beetle; caterpillars; grain; herbage.
12	♀	May 18	do	1	99	Leg of beetle; seeds; herbage.
23	♀	May 27	Flandreau, S. Dak	50	50	One beetle; many caterpillars; seeds; herbage.
34	♂	June 6	Ortonville, Minn	3	97	A few caterpillars and beetles; seeds.
35	♀	June 6	do	25	75	20 larvæ; grasshopper's leg; small insects; oats; basswood seeds; herbage.
36	♂	June 6	do	50	50	Larvæ; fragments of insects; basswood seeds; vegetable matter.
37	♂	June 6	do	20	80	26 coleopterous larvæ; seeds; herbage; piece of *Equisetum* stem.
39	♂	June 7	do	50	50	Coleopterous larvæ; cricket; small insects; spermophile hair; vegetable matter.
40	♀	June 7	do	50	50	Over 20 coleopterous larvæ; remains of vegetable matter.
41	♂	June 7	do	50	50	Coleopterous larvæ; cricket; beetle; smaller insects; vegetable matter.
42	♂	June 7	do	50	50	Beetles and caterpillars; hulls and fibrous vegetable matter.
45	♂	June 8	do	45	55	A caterpillar's skin; bit of vegetable fiber; black indeterminate matter.
46	♂	June 8	do	10	90	Caterpillar remains; hulls of oats and perhaps other grains; hulls of basswood seeds; chewed vegetable matter.
47	♂	June 8	do	25	75	Over a dozen caterpillars; seed pulp; herbage.
61	♂	June 11	do	5	95	Beetles; lepidopterous larvæ; feathers; some of the animal's hair; chewed vegetable matter; a few grain hulls; basswood seeds.
72	♀	June 18	Fort Sisseton, S. Dak	90	10	Mostly insects; larvæ; ants; a little vegetable matter.
74	♂	June 20	do	25	75	Insects; grain; herbage.
75	♂	June 22	Browns Valley, Minn	5	95	A few bits of insects; strawberry seeds; herbage; grain.
90	♀	June 28	do	50	50	Mostly grasshoppers and roots.
128	♀	July 8	do	50	50	Large white grubs (larvæ of beetles), vegetable matter.
134	♂	July 12	Harwood, N. Dak	10	90	Insects and vegetable matter; strawberry seeds.
135	♀	July 12	do	25	75	Insects; finely chewed herbage and seeds; strawberry seed.
138	♀	July 18	Grand Forks, N. Dak	50	50	Insects; one larva; shells of beetles; oats.
146	♂	July 19	do	5	95	A few pieces of insects; chewed grain
147	♂	July 22	Pembina, N. Dak	15	85	Small insects, hairs of *Spermophilus 13-lineatus;* wheat; seeds of *Chenopodium.*
148	♂	July 22	do	20	80	Crickets; beetles; leaves; roots; grain; indeterminate matter.
168	♂	July 26	do	75	....	Eggs of some insect; indeterminate matter.
209	♂	Aug. 10	Devils Lake, N. Dak	1	90	Feathers; a few hairs; oats; skins and seeds of *Solanum* berries.
210	♂	Aug. 10	do	15	85	Caterpillar; cocoon and chrysalis; 1 feather; hairs; roots and wheat.

KENNICOTT'S SPERMOPHILE.

Spermophilus spilosoma obsoletus Kennicott.

[Map 3, A.]

Description.—This is an obscurely marked, dull-colored, little spermophile with ears hardly perceptible and short, slender tail. The lower parts are white or soiled whitish, the sides yellowish white. The back is ashy gray, usually covered irregularly with obscure spots of whitish, bordered posteriorly by black. It is unlike any other species near its known range, but resembles quite closely some of the forms of *Spermophilus spilosoma* in western Texas, New Mexico, and Arizona.

The following measurements are those of an average sized specimen selected from fifteen adults: Total length from end of nose to end of tail vertebræ, 222 millimeters (8¾ inches); length of tail from base to tip of vertebræ, 62 millimeters (2½ inches); hind foot, heel to tip of claw, 32 millimeters (1⅓ inches).

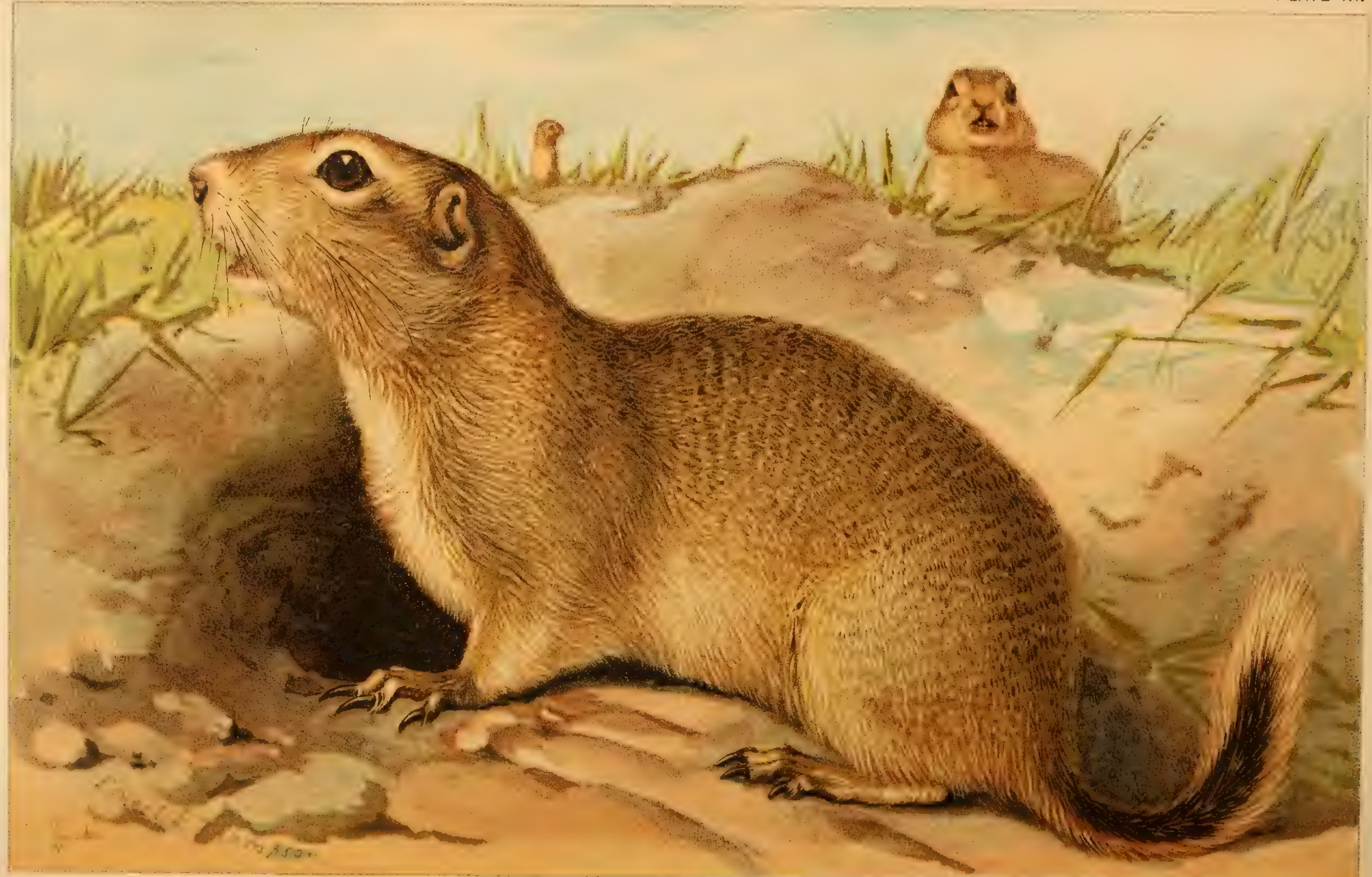
This species was first described in 1863 by Robert Kennicott, from specimens taken at O'Fallon's Bluff, on the Platte River, Nebr. Dr. Allen calls it Kennicott's Spermophile, but so far as I have been able to learn, no common name has been applied to it by people living within its range. It is sometimes spoken of as the little Spotted Ground Squirrel in contradistinction to the Striped Prairie Squirrel (*Spermophilus tridecemlineatus*), as both species are found in the same localities.

So far as our present knowledge goes, its range is limited to Nebraska, eastern Wyoming, and South Dakota south of the Black Hills. In Nebraska it has been taken 50 miles west of Fort Kearney, at Valentine on the Niobrara River, and has been reported at Fort Robinson. It has also been found on the South Fork of White River, S. Dak.; at Fort Laramie, Wyo.; and and at Sterling, Colo. The sandhill region of western Nebraska seems to be the center of its abundance. I have met with them at several points in Cherry County, where they seem to be more common than the Striped Spermophile and of nearly similar habits.

They were so shy and quiet and their colors and markings blend so perfectly with their surroundings that they are rarely seen, although not difficult to catch in traps. They usually choose the light sandy soil in which to make their burrows, a habit possessed in common by the kangaroo rat (*Perodipus ordii*), which occurs in this locality and at the unoccupied holes of which they are frequently caught. The habit of the kangaroo rat of digging many more holes than it can occupy or has any apparent use for seems to be appreciated by this spermophile as well as by a number of other species of small rodents, which appropriate them instead of digging holes for themselves, although Kennicott's Spermophile does construct a burrow for itself.

We may infer that the young are born and cared for in the burrows until old enough to be safely trusted above ground. They seem to be brought forth later than the young of most spermophiles. On June 20, 1888, I caught two females, each containing eight young that would not have been born for some time. In the case of each of these

PLATE III.



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RICHARDSON'S SPERMOPHILE, SPERMOPHILUS RICHARDSONII (Sabine.)

females the teats numbered ten, indicating that larger litters of young may sometimes be produced.

I have heard the voice of this spermophile on but one occasion, when I mistook it first for the voice of the Striped Spermophile, but after catching the animal it occurred to me that the voice was higher and more like that of the Sonoran Spermophile (*Spermophilus spilosoma*), to which this species is most nearly related. However, there is so little difference between the voices of *S. tridecemlineatus* and *S. spilosoma* that the one might be mistaken for the other unless careful attention be given them by one familiar with both.

Food.—Of the food habits of this species we know very little. The stomach of one specimen that I examined at Kennedy, Nebr., April 24, 1888, contained seeds and the remains of some young mice. The stomach of another taken on the same day contained seeds and insects. Other stomachs examined contained seeds, green herbage, and insects. From these few examples it would seem that their food is nearly as varied and of much the same nature as that of the Striped Spermophile.

From an economic point of view this species is not of great importance from the fact that it is not numerous in farming districts. Most of the country inhabited by it is grazing land and but thinly settled. The most serious complaint against it is that it digs up the tree seeds planted on timber claims on the Nebraska prairies, but this may be obviated by proper care. Those living in the neighborhood of fields or where trees are planted may be easily killed by any of the methods described on pp. 25–27. When once killed off near the fields, others will not spread over the ground for some time, usually not until the crop is beyond their reach.

RICHARDSON'S SPERMOPHILE.

Spermophilus richardsoni (Sabine).

[Plate III—Map 4.]

Description.—Richardson's Spermophile, with its short legs, tail, and ears, strongly resembles a small prairie dog in general form and color. It has no distinct markings or pattern of coloration; the outer coat is composed of longer hairs covering the fur; the inner fur is soft and silky, even in August, becoming thick and beautiful in autumn. The lower parts are plain buffy, becoming brighter on the shoulders and sides of neck; the top of the head, cheeks, and back are grayish buffy from a mixture of black hairs and the darker under-fur; the tail is plain buff below, washed on the upper surface with black, and bordered by lighter buff. No dark lines are visible in the colors of the tail, but the back is faintly marked with fine dots or wavy crosslines.*

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* The only animal with which it can be confounded is *S. richardsoni elegans,* a southern subspecies, somewhat darker colored and less buffy. Specimens from North Dakota and Manitoba are the true *richardsoni*, while those from Wyoming and Idaho are referred to *elegans*. At some future time it may be possible to draw an arbitrary line across Montana separating the two forms.

The following measurements of a specimen selected from eleven adults represent the average size: Total length, from end of nose to end of tail vertebræ, 311 millimeters (12¼ inches); length of tail vertebræ from angle at base to tip, 82 millimeters (3¼ inches); length of hind foot, from heel to tip of longest claw, 46 millimeters (2 inches).

Range.—Like Franklin's Spermophile this species was first described by Sabine from specimens collected at Carlton House on the Saskatchewan River more than 70 years ago, and this locality is still the northernmost known point of its distribution. Fortunately it ranges over a comparatively small area in the United States, being restricted to North Dakota and Montana; but in Canada it covers the great plains of Assiniboia and Saskatchewan. The eastern limit of its range may be marked by a line passing in a southeasterly direction from Carlton House through Petrel and Carberry, Manitoba, to the United States boundary, some distance east of Turtle Mountain. In the Red River Valley it occurs from Mayville south to Harlem, N. Dak. Aberdeen, S. Dak., in the James River Valley, is the southernmost point at which it is known. In North Dakota and Montana we have no records of its occurrence south of the Missouri River though the species is more or less common at Bismarck, N. Dak., and at the mouth of Milk River and Fort Benton, Mont. In the latter State it is found as far west as the Rocky Mountains, at Chief Mountain, Birch Creek, and Choteau.

Its southern subspecies, the Wyoming Spermophile (*Spermophilus r. elegans*), extends over the sage plains of Wyoming from Cheyenne and the Laramie Mountains westward to Idaho. It is also found in northern Utah and at Fish Creek in the extreme northern part of Colorado. In Idaho it is chiefly a harmless occupant of uncultivated lands; but in Wyoming it does immense damage to crops.* Richardson's Spermophile is extremely abundant about the little town of Bottineau, where it is found only on high prairies, and seems to avoid brushy or low weedy land. It is generally distributed over the prairies, but in some places has collected about grain fields and does considerable damage by eating, carrying away, and destroying grain.

Habits.—Like every species of spermophile that I have observed, these animals are strictly diurnal. From sunrise till about 9 o'clock they are very active, and may be seen running or sitting up all over the prairies, even at the very edges of towns. After 9 a. m. they retire to their burrows and are rarely seen during the rest of the day; but as these observations were made late in August, it is probable that the animals were then nearly ready to hibernate, and consequently spent more time sleeping than earlier in the summer.*

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*Prof. F. J. Niswander, entomologist of the Wyoming Experiment Station, gives the following account of its depredations: "On the Laramie experiment farm the acre plat, containing several varieties of barley, was so badly injured that, in some instances, the yield was less than the amount of seed sown. The plats containing the different varieties of oats were also badly damaged. Our acre plat was not harvested owing to the ravages of these squirrels. Of several varieties harvested only enough seed was obtained to repeat the experiment during the present season.

"Mr. J. S. Meyer, superintendent of the experiment farm at Lander, Wyoming, says: 'We are bothered a great deal with gophers; they are death on carrots and alfalfa.'" (Wyoming Experiment Station Bull. No. 12, April, 1893, p. 25.)

They are the least suspicious and most inquisitive of all the spermophiles I have known. They would stand watching me until I approached within a few rods, and if finally frightened into their holes would soon reappear to watch me from their doorways. Probably as they become better acquainted with man and his gopher-destroying inventions, they will learn to be more suspicious and less inquisitive. When running, they flop their short tails up and down like a woodchuck or prairie dog, and when sitting up they keep shaking them as they chipper, just as prairie dogs do.

Their holes are large, with a little mound of earth like a pocket gopher's hill in front of each. They seem to be quite deep and to descend with a steep pitch for the first few feet.

Of thirteen specimens taken near Bottineau, N. Dak., twelve were males. All were very fat, and were in good condition to hibernate as soon as the ground began to freeze. It was too late in the season to learn anything of their breeding habits, but Mr. Ernest E. Thompson, in his list of the mammals of Manitoba, says: "My notes on the breeding season are very brief and inconclusive, but such as they are, they indicate that the young are born about the middle of May. They number sometimes as high as eleven. About the end of June they are half-grown, and begin to show themselves outside of their burrows." He also states that they appear above ground in spring before the snow is gone, which is some time before the appearance of the Striped Spermophile, and that they do not hibernate in autumn till about a fortnight later than that species.

The spermophiles that do not live near grain fields feed largely upon green vegetation, grass, and various plants. Roots of plants are eaten, and a great many seeds, especially those of pigweeds (*Chenopodium album* and *boscianum*) and wild sunflowers, which are abundant and form a considerable part of their diet. They also eat grasshoppers and many other insects. One that I shot as it ran out from under a shock of oats had 269 grains of oats in its cheek pouches. Mr. Ernest E. Thompson records 162 grains of oats taken from the cheek pouches of one and 240 grains of wheat and nearly 1,000 grains of wild buckwheat from those of another. Still the loss from ripe grain eaten, stored away, and destroyed in autumn is small compared with that which they cause by digging up the seed after it is sown in spring. Each kernel taken then deducts many fold from the autumn yield.

Dr. Coues has written the most complete account we have of the habits of Richardson's Spermophile, with which he became familiar when attached to the northern boundary survey along the forty-ninth parallel. He says:

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* That this surmise is correct is proved by the observations of Dr. A. K. Fisher, who found them active throughout the entire day, earlier in the season.

"It is one of the most abundant animals of our country, occurring by hundreds of thousands over as many square miles of territory, almost to the exclusion of other forms of mammalian life. Millions of acres of ground are honeycombed with its burrows. * * * I never saw any animals—not even buffalo—in such profusion. I have ridden for days and weeks where they were continuously as numerous as prairie dogs are in their populous villages. Their numbers to the square mile are vastly greater than I ever ascertained those of *S. beecheyi*, the pest of California, to be, under the most favorable conditions. In a word, their name is legion. If Dakota and Montana were the garden of the world (which they are not, however), either the gophers or the gardeners would have to quit. * * * Traveling among them, how often have I tried to determine in my mind what particular kind of ground, or what special sites they preferred, only to have any vague opinion I might form upset, perhaps in a few hour's more riding, by finding the animals as plentiful as ever in some other sort of a place. Passing over a sterile, cactus-ridden, alkali-laden waste, there would be so many that I would say 'this suits them best'; in camp that very night, in some low grassy spot near water, there they would be, plentiful as ever. One thing is certain, however; their gregarious instinct is rarely in abeyance. A few thousand will occupy a tract as thickly as the prairie dogs do, and then none but stragglers may be seen for a whole day's journey.

"Their choice of camping grounds is however wholly fortuitous, for all that we can discover, and moreover the larger colonies usually inosculate. * * * If the animals have any preference, it is a choice of the lighter and more easily worked soils, rather than a question of location. They seem to haunt especially the slight knolls of the prairie a few feet above the general level. There the soil is looser, and the inhabitants have some little additional advantage in their view of the surrounding country. But there are plenty of burrows in the heaviest soil of the creek bottoms. They dislike stony places for obvious reasons, yet they will often burrow beneath a single large rock. I have also found nearly horizontal holes of theirs dug from the face of an almost perpendicular bank. In short, there is endless diversity in the details of their habitations. * * * There is one very curious point in the socialism of these animals. Every now and then, in odd out-of-the-way places, where there may not be another gopher for miles perhaps, we come upon a solitary individual guarding a well-used burrow, all alone in his glory. The several such animals I have shot all proved to be males; and what is singular, these old fellows are always larger than the average (some would weigh twice as much), peculiarly sleek and light colored, and enormously fat. The earlier ones I got I suspected to be a different species, so peculiar were they in many respects. I suppose they are surly old bachelors who have forsworn society for a life of indolent ease, though if I had found them oftener among their kind I should have taken them for the Turks of the harem. It seems to be a case somewhat parallel with that of the lonely old buffalo bulls so often met with away from the herd. The female brings forth in June. This I infer, at least, from the circumstance that July brings us plenty of young ones two-thirds grown. The young probably keep closely in the burrow until they are of about this size—I do not remember to have seen any smaller ones running about. * * * The gathering and hoarding of seeds seems to be their principal occupation during the summer.

"Amidst thousands that we pass only to see them skurry into their holes in trepidation, there are necessarily some observed which do not notice us or at any rate do not take alarm. I have often watched them, where the grass was taller than usual, gathering their store. They rise straight up on their haunches, seize the grass top and bite it off. Then, settling down with a peculiar jerk, they sit with arched back, and stow away their provender in their pouches with the aid of their fore paws. Their cheek pouches are not very large—both together would hardly hold a heaping teaspoonful. When duly freighted they make for their holes. Their mode of feeding, as they do, upon grass blades or any other herbage, as well as upon seeds, is essentially the same. In their foraging excursions, they seem to have regular lines of travel. From almost every long-used hole may be seen one or more little paths an inch or two wide, sometimes so well worn that they may be traced 15 or 20 feet. These paths often run from one hole to another. No matter how smooth the ground, these paths are never quite straight; they repeat in miniature the devious footpath across the meadow, the mysterious something that prevents an animal from walking perfectly straight being in force here. Though properly a vegetarian, like other rodents, the gopher is fond of meat, and I think that no small share of his summer's food is derived from the carcasses of buffalo. Wolves do not appear to be numerous, in summer at least, in this region, and the polishing of buffalo skeletons is largely accomplished by the kit foxes, badgers, skunks, and gophers. Hard by a slain buffalo a badger's hole is pretty sure to be soon established, together with a number of temporary gopher burrows. In proof positive of this carnivorous propensity, I have more than once seen the inside of a drying carcass completely covered with the peculiar and readily recognized excrement of the gophers, while the bones and flesh were gnawed in a way that plainly told who had been there. * * * Comical as a gopher is in some of his attitudes and motions, he never looks so funny as when squeaking. He generally gets down on all fours to it, drops his jaw with a jerk, and squeezes out the noise by drawing in his belly—it reminds one of a toy dog. If caught or wounded, they have an energetic chattering outcry, much like that of other species." * * * (American Naturalist, IX, 1875, pp. 148–154.)

In the interval of eighteen years since Dr. Coues published this account of the spermophile's habits, changes have taken place. The Dakotas and Montana are not yet the garden of the world, though the Dakotas represent a fair share of the world's wheat field. Mile on mile of waving grain now occupies the ground then held in undisputed possession by the buffalo and spermophiles. The buffalo have disappeared and their bleached bones have been gathered up and sold. The spermophiles remain and are apparently increasing, much to the alarm and annual loss of the farmers of the region inhabited by them. The increase may be only apparent from crowding them out of plowed land to the bordering prairie. As the plow breaks up and fills their burrows and grain springs up high above their heads, they move to the edges of the fields, where more natural surroundings are found and where they can choose their food from either prairie or field. Thus covering a smaller area their numbers appear greater. At the same time their old enemies, badgers, weasels, foxes, and hawks, are destroyed or driven back from settlements, and the spermophiles multiply more freely unless a constant war of extermination be waged against them. As the situation becomes serious various means are employed for their destruction. County officers, in the hope of lessening their numbers, offer bounties with the only visible result of emptying the county treasury. Men and boys are employed on some of the farms to shoot and poison them. The Department of Agriculture is frequently appealed to for help or advice in the war against them.

Injury to crops.—Many complaints have been received, particularly from North Dakota, from farmers living in the region where Richardson's Spermophile is common. Mr. Rollin C. Cooper, of Cooperstown, Griggs County, writes as follows: "*Spermophilus richardsoni* is present in great numbers and very destructive to small grain, doing most damage after the grain begins to head out and shade the ground fully; they then pull down the grain and cut off the upper part of the stalk for many rods around their holes, seemingly to let sunlight strike the ground; they do not like damp places and are more numerous on rolling than on flat ground. I farm 7,000 acres and I think I can rid my farm of gophers at little expense by using wheat poisoned with strychnine."

Under date of July 15, 1889, Mr. G. W. Sewell, of Rugby, N. Dak., describes the manner in which this species injures the crops in Pierce county: "We have a gopher here that is so destructive that we shall have to do something to protect ourselves or leave the country. I have lived in the grasshopper and chinch-bug countries; the gopher is worse than either. We have a fine stretch of land south of the Turtle Mountains, but the entire community is discouraged by the destructiveness of the gophers which seem to be native to this part of Dakota. They go into the ground in September and October and stay till the snow melts, say April 20. Then they come in great numbers and seem to be always starved; they will eat anything: grass, grain, meat, potatoes, onions, horse manure. When we commence working the land in spring they are all over the fields and eat the seed wheat. They come in from all the vacant land about and eat the wheat from the time it has sprouted until 2 inches high; then they eat the blades. By May 20 or the 1st of June they have a litter of about eight young. They destroy wheat, corn, beans, and dig out flax seed and potatoes. They commence cutting down stalks of wheat about June 15 and continue to cut them until ripe; then they shell out the grain and carry it into their holes. They cut down the prairie grass where there is no grain. At certain times they eat each other when found dead. They are too numerous to count. They have destroyed from 60 to 80 acres of grain for me, and in some places have destroyed 60 per cent of the crop."

Mr. Elmer T. Judd, writing from Cando, N. Dak., August 1, 1890, gives the following account of the damage done in Towner County and the means adopted for the destruction of this pest:

"The Richardson's Gopher which I send is one of almost countless numbers which are found in this county. They do a great deal of damage to the crops, commencing their work when the wheat and other grain are sowed, and continuing until after they are harvested. They dig up the seed and then eat the young shoots. During a dry spell they simply cut the stalks off for the moisture there is in them, and when the grain is nearly ripe they commence breaking down and picking the grain from the heads.

"Some farmers calculate they can make wages killing gophers in the extra amount of wheat they get at harvesting time. An old gentleman here, familiarly known as 'Grandpa Main,' who is in the neighborhood of 60 years of age, killed 1,500 gophers by actual count before the 1st of June, many of which he opened and found to contain from 5 to 7 young. From about the 1st of June until the middle of July this man and a cotton broker from St. Louis, Mo., who spends the summer here on his farm, calculated that they had killed over 2,500 more. One afternoon they killed 135, as shown by the tails they had captured. This shows the number of gophers one man could destroy if he paid strict attention to the business. The above 4,000 gophers were killed on and around the outer edges of one section of land—1 square mile."

Prof. C. B. Waldron, arboriculturist of the North Dakota Agricultural College and Experiment Station, reports that in eastern North Dakota this spermophile has extended its range considerably to the south and east during recent years, and has become much more abundant than formerly, while at the same time Franklin's Spermophile has decreased in the same area, the inference being that the latter is being driven out by Richardson's Spermophile, as the brown rat has driven away the black rat and the red fox the gray fox over large areas. Prof. Waldron says: "At Amenia, Cass County [N. Dak.], *Spermophilus richardsoni* first appeared in 1887 and has since increased rapidly, *S. franklini* meanwhile diminishing till now perhaps not more than a dozen of the latter will be seen in the course of a whole season. At Leonard the *S. richardsoni* has appeared this season for the first time, but at Power, 10 miles south of there, it first appeared in 1891. At Jamestown this gopher was first noticed in 1884, though at Sanborn it seems to have appeared sooner, probably as early as 1876. At Mayville it first appeared in the seasons of 1886 and 1887, having entered that region from the west. Since there are areas of considerable extent in Barnes County where this species has never been noted, it would indicate that it has passed into its new habitat along irregular lines. Its movement in the second tier of counties west of the Red River seems to have been south and east.

"*Spermophilus richardsoni*, which bears the characteristic and very appropriate name of 'flickertail,' is harder to contend with than any other species of this genus, the damage done by it being more and more each year. Its chief depredations are committed during the months of June and July when growing grain, especially corn, peas, and garden crops are apt to be entirely destroyed by it. It is found in greatest abundance in the agricultural regions lying just west of the Red River Valley and seems to thrive best in the presence of civilization. For several years it has been encroaching upon the farms in the Red River Valley proper, but the wet season of last year [1891] very nearly or quite exterminated it on the level lands."

FOOD.

The following table prepared from the examination of the stomachs of eighteen specimens will give a more definite idea of the character of the food of this species. Unfortunately the dates at which these specimens were taken cover little more than half of one month, none being taken in spring or early summer, when their diet is of greater importance in relation to agriculture.

Summary.—Animal matter, 9.5 per cent; vegetable matter, 90.3 per cent; indeterminate matter, .2 per cent.

This shows a diet of less insect and more vegetable matter than that of either the Gray or Striped Spermophile, but the stomachs of this species were all collected during the month of August, when in the latitude of 48° to 49°, insect life is waning and there is a profusion of the rich, oily, and fat-producing seeds and grains. However, the large proportion of green herbage found in their stomachs clearly proves them to be far more herbivorous than is usual with others of the genus and shows a close connection in food habits, as well as in many other respects, with the prairie dog.

Table showing contents of 18 stomachs of Richardson's Spermophile (Spermophilus richardsoni).

Cat. No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
220	♂	1887. Aug. 13	Devils Lake, N. Dak		100	Mostly oats; some herbage.
222	♂	Aug. 15	do	20	80	A few small insects; mouse hair; mostly herbage or roots.
223	♂	Aug. 15	do	5	95	A few bits of insects; grain; herbage; a *Polygonum* seed.
225	♂	Aug. 17	do		100	Herbage; *Chenopodium* seeds; *Solanum* seeds and berries.
226	♂	Aug. 17	do		100	Half wheat; nearly half green herbage; a few small seeds.
227	♂	Aug. 17	do		100	Oats.
233	♂	Aug. 24	Bottineau, N. Dak		98	Mostly barley and seeds of bindweed; few particles of indeterminate material.
234	♂	Aug. 24	do	10	90	Grasshoppers; grain; green foliage.
235	♂	Aug. 24	do	10	90	Hair; mostly green herbage; probably grass.
236	♂	Aug. 24	do	75	25	Finely chewed insects (probably mostly grasshoppers); plants; *Chenopodium* seeds.
237	♂	Aug. 24	do	5	95	Insect remains; shell of black beetle; *Solanum* seeds; small seeds; plants.
238	♂	Aug. 24	do	5	95	A few insects; a little grain; mostly chewed roots.
239	♂	Aug. 24	do	5	95	Grasshoppers; barley; *Polygonum* seeds; green herbage.
240	♂	Aug. 24	do	20	80	Grasshoppers; grain and herbage in about equal amounts.
241	♂	Aug. 24	do	1	99	One small feather; chewed leaves and seeds; *Chenopodium* seeds.
251	♂	Aug. 26	do		99	Mostly barley; a few *Polygonum* seeds; some indeterminate matter.
257	♂	Aug. 29	do		100	Green herbage; seeds of *Helianthus* and *Chenopodium*.
258	♂	Aug. 29	do	15	85	Grasshoppers; green herbage; *Helianthus* and *Chenopodium* seeds.

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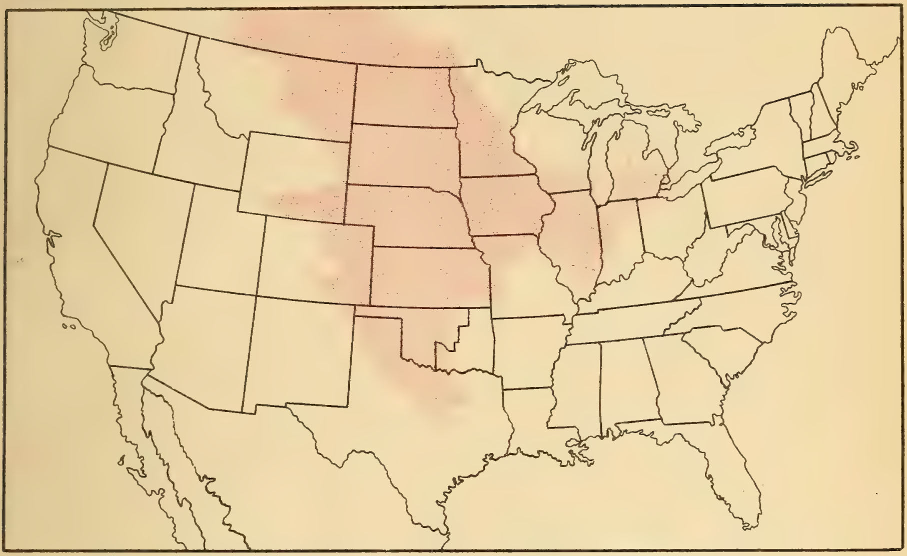
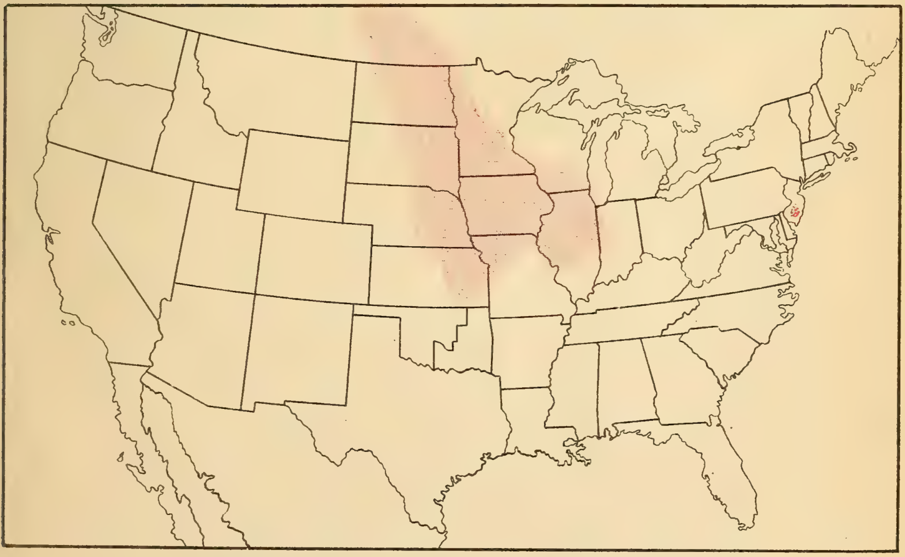


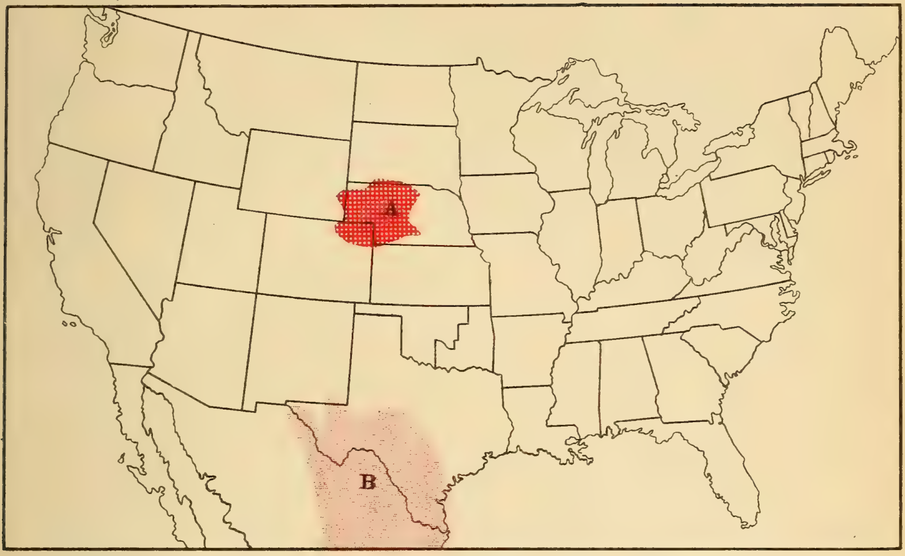
DISTRIBUTION OF THE STRIPED SPERMOPHILE
(*Spermophilus tridecemlineatus*)

MAP 2



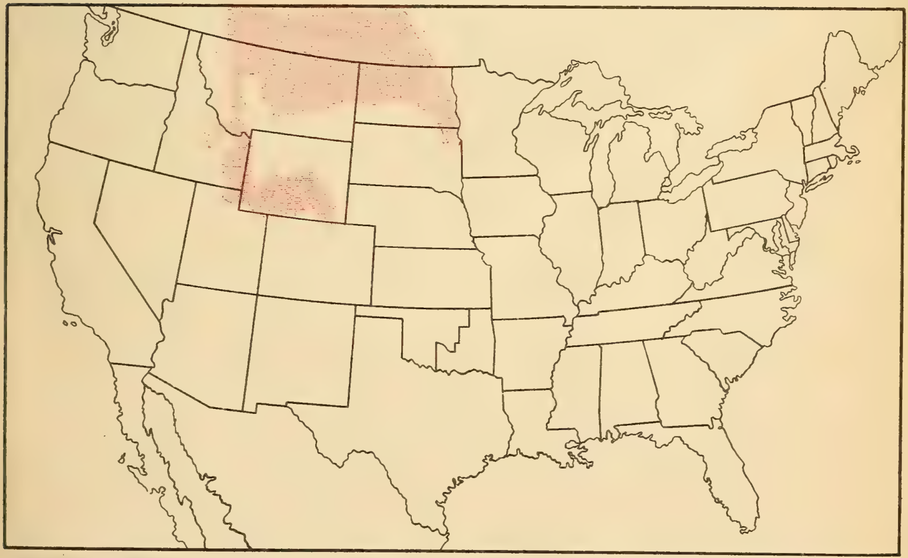
DISTRIBUTION OF FRANKLIN'S SPERMOPHILE
(*Spermophilus franklini*)

MAP 3



A. DISTRIBUTION OF KENNICOTT'S SPERMOPHILE (*Spermophilus s. obsoletus*)
B. DISTRIBUTION OF THE MEXICAN SPERMOPHILE (*Spermophilus mexicanus*)

MAP 4



DISTRIBUTION OF RICHARDSON'S SPERMOPHILE (*Spermophilus richardsoni*) and THE WYOMING SPERMOPHILE (*Spermophilus richardsoni elegans*)

BULLETIN No. 5.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

THE
POCKET GOPHERS
OF THE
UNITED STATES

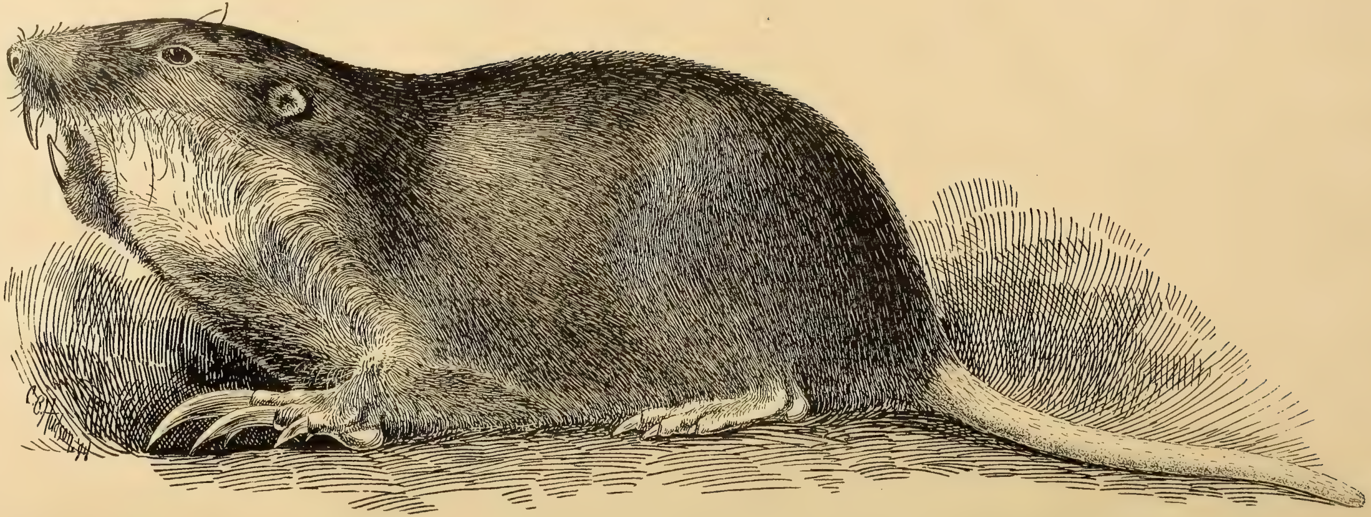
PREPARED UNDER THE DIRECTION OF DR. C. HART MERRIAM
CHIEF OF DIVISION

BY

VERNON BAILEY
CHIEF FIELD AGENT

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1895



GEORGIA GOPHER, GEOMYS TUZA (Ord.).

/3

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THE POCKET GOPHERS OF THE UNITED STATES

Prepared under the Direction of Dr. C. HART MERRIAM
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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., January 31, 1895.

SIR: I have the honor to transmit herewith Bulletin No. 5 of this division, treating of the habits, economic status, and means of destruction of the Pocket Gophers of the United States. It has been prepared by Vernon Bailey, chief field naturalist of the division, and is complementary to a technical paper on the group this day issued by the division (North American Fauna, No. 8).

Respectfully,

C. HART MERRIAM,
Chief of Division of Ornithology and Mammalogy.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

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THE POCKET GOPHERS OF THE UNITED STATES.

INTRODUCTION.

The aim of the present bulletin is to give a popular account of the Pocket Gophers of the United States.

The name 'Gopher'[1] is applied to these animals throughout the greater part of the region they inhabit, though in the Southern States they are commonly called 'salamanders.' Since the real salamanders are lizard-like animals, once believed to live in the fire, it seems probable, as suggested by Dr. Goode, that the name was given to the Gophers from the sudden appearance of their fresh mounds on ground recently blackened by fire. In the Mississippi Valley the name Gopher is used for the ground squirrels as well as the Pocket Gophers, while in the south a burrowing turtle (*Gopherus polyphemus*) is called by the same name. From the Gophers' habit of living underground they are sometimes confounded with the moles. A greater mistake could not be made, for the moles belong to the widely different order of insectivores and are among the most beneficial of mammals.

The Pocket Gophers are sturdy little animals, well adapted to underground life. Their bodies are stout and compact, their eyes are small, almost rudimentary, and their front feet are armed with strong, curved claws for digging. The appearance of a characteristic species is shown in the frontispiece. Gophers can lay no claim to beauty, either in graceful form or in pleasing contrast of colors; but their coats of plain earthy browns harmonize perfectly with the color of the soil. What seems like fur is in reality soft, silky hair, with a smoothness and gloss that repels the dirt and keeps the animal bright and clean though in constant contact with the soil. Such beauty as they have lies in their perfect adaptation to a peculiar mode of life.

Pocket Gophers belong among the rodents or gnawers. In general they may be recognized by their peculiar form, already described, and by the presence of cheek pouches opening outside of the mouth. The only other mammals having external cheek pouches are the pocket mice and kangaroo rats, which differ from the Gophers in slender, graceful forms, long tails, and long hind legs. The Gophers may be subdivided into two groups, those with grooved front teeth and those with smooth front teeth (see figs. 1 and 2).

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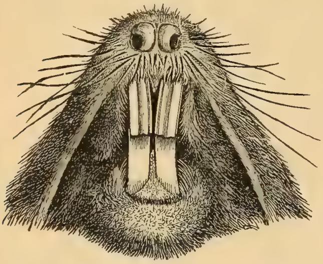
[1] From *Gaufre* of the early French explorers

The harmfulness of these animals is perhaps best shown by the fact that single counties have paid for their destruction in one year as much as $14,000.* That animals living below the surface of the soil, rarely seen and to most people unknown, can be the cause of enough mischief to bring such a price upon their heads may surprise many people. A careless observer might travel for weeks over the western prairies and not be aware of their presence, and yet the buffalo and antelope in their past abundance were not one-tenth as numerous. Unlike larger animals, Gophers do not disappear before man unless as the result of his direct and continuous efforts toward their destruction. They remain in his fields working havoc among crops, killing his choicest trees, eating the roots from garden vegetables, and destroying meadows and fields of grain. They breed and multiply beneath his very feet, and work as silently and unobservedly as the frost, while the result of their work is shown above their tunnels by lines of whithering and dying plants.



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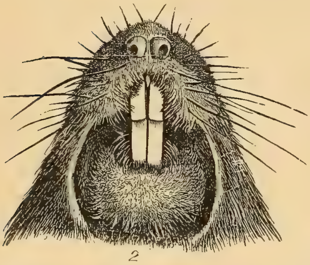

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FIG. 1.—Face of *Geomys bursarius*, showing grooved upper incisors and opening of cheek pouches.

FIG. 2.—Face of *Thomomys talpoides*, showing plane upper incisors and openings of cheek pouches.

There is another side to the question, and the Gophers should be given full credit for the important part they have played in mixing and enriching soils. Still, the verdict must go against them. We must protect our crops.

There is no demand for legislation or for any concerted action. The bounty system has been repeatedly tried and has always proved a failure and a waste of the funds of county or State, as shown beyond. There is little difficulty in destroying the Gophers on a farm, and once reduced their numbers may be easily controlled.

GENERAL HABITS.

Underground life.—Even where Gophers are so numerous as to be exceedingly troublesome, few people are familiar with them in life; they keep so close to their underground tunnels as to be rarely observed unless caught in traps. By patient watching a little brown head may sometimes be seen for an instant while the animal pushes a load of earth from a freshly opened hole; and on rare occasions the whole animal appears above ground but disappears again so quickly that the eye hardly catches its form. Still more rarely one may be met with following a road or path remote from its hole.

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*Poweshiek County, Iowa, paid $14,000 in bounties, at the rate of 10 cents a scalp, in 1890.

As Pocket Gophers spend their lives underground, their whole organization is modified in accordance with the needs of a subterranean existence. The different kinds, though numerous, are very much alike externally. They are short-legged, thickset animals, without an appreciable neck, without noticeable external ears, and with very small eyes. The feet are largely developed for digging. The forepaws in particular are very strong, are armed with long curved claws, and the sides of the toes are lined with rows of bristles that evidently serve in preventing the dirt from passing between the fingers (fig. 3), thus completing a more effective arrangement for keeping the tunnels clean, and for pushing the earth out of the openings in the burrows. The tail, which is of moderate length, is thick, fleshy, and usually devoid of hair, and is endowed with tactile sensibility.

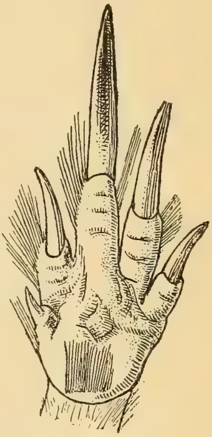

FIG. 3.—Left forefoot of *Geomys personatus*, showing the rows of bristles which form brushes on the sides of the toes.

The Pocket Gophers, in working their way through the earth in the construction of their tunnels, use the powerful upper front teeth as a pick to loosen the ground. At the same time the fore feet are kept in active operation, both in digging and in pressing the earth back under the body, and the hind feet are used in moving it still farther backward. When a sufficient quantity has accumulated behind the animal, he immediately turns in the burrow and by bringing the wrists together under the chin, with the palms of the hands held vertically, forces himself along by the hind feet, pushing the earth out in front. When an opening in the tunnel is reached the earth is discharged through it, forming a little hillock that resembles in a general way the hills thrown up by moles. In many Gophers there is a naked callosity or 'nasal pad' over the anterior half of the nose, which must be of great assistance in the construction of the tunnels.

The substance of the following notes on the habits of a live Gopher in captivity is from a technical paper recently published by Dr. C. Hart Merriam:*

A Pocket Gopher from Vernon, Texas, ran backward as rapidly and easily as forward. This method of progression was particularly noticeable when the animal could follow a runway or other accustomed route. When carrying food to one of his storehouses he rarely turned around, but usually ran backward to the place of deposit, returning for more, and repeating the operation again and again, the to-and-fro movement suggesting a shuttle on its track. The well-known peculiarity of the external genitalia, which are so hidden and modified that the sexes are determined with difficulty, is doubtless the result of this habit, protecting the parts from injury when the animal is moving backward.

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* North American Fauna, No. 8, January 31, 1895.

In all Pocket Gophers the tail is rather large and fleshy, and as a rule is naked or scantily haired. Its function had long been a puzzle, but the Gopher above mentioned used it as an organ of touch when running backward. The tail is doubtless endowed with special sensibility and is evidently of great value in warning the animals of the presence of an enemy in the rear when they are traveling backward in their dark tunnels.

In walking on soft ground the forefeet are usually held in the normal position, with the soles down, or inclined slightly inward. In walking on hard ground, however, the forefeet are turned sideways, their soles facing one another, so that the claws curve inward, and the animal walks on the outer or ulnar side of the foot. This method of using the forefoot in walking on hard substances was frequently observed, and enables the animal to walk comfortably where the long curved claws would be in the way if held in the normal position. It was also frequently noticed that the feet were held in the same position (horizontally) when at rest, and when used as a scoop in pushing loads of earth or sand out of the way. When thus engaged the feet were drawn back under the breast, the wrists near together and the long claws turned outward. By moving the body quickly forward the animal always succeeded in throwing ahead of it a considerable quantity of loose earth.

Burrows.—Gopher burrows seem to have neither beginning nor end. They are extended and added to year after year, and in many cases those dug by a single animal would measure a mile or more if straightened out. I have never attempted to ascertain the actual length of one, but feel secure in making the above statement. At the end of a year a Gopher may often be found within 20 rods of the point from which he started, but in traveling this distance he has paid no attention to the points of the compass. He follows a tender root for a few feet, then moves to one side, encounters a stone, and makes a second turn. A layer of mellow soil entices him off in another direction, and so on through a thousand devious crooks and turns. Sometimes the main passage swings around and crosses itself, or numerous side branches are extended varying distances. The main tunnel usually runs from 6 inches to a foot below the surface. At intervals varying from a few feet to a few rods openings are made through which to discharge the earth that makes the little piles called 'gopher hills.' The openings are closed by being packed so full of dirt that no trace of the runway is visible except the little mounds that mark its course. An average-sized gopher hill contains 5 or 6 quarts of earth, but the quantity varies from a pint to a bushel. They are generally circular and a foot or more in diameter. The quantity of dirt in each varies greatly with different kinds of soil and according to the distance between the hills. In mellow soil both holes and hills are larger than in hard soil. I once counted the hills thrown out by three Gophers (*Geomys bursarius*) twelve days after a rain. The numbers were respectively 28, 35, and 40. As the Gophers work all summer and to some extent through the winter, the total quantity of earth brought to the surface and the total area covered are considerable. For example, in the central part of Minnesota, where the ground is unfrozen for seven months in the year, the lowest number in the three cases mentioned, 28 hills in twelve days, would result in 490 hills in seven months, or at least 500 square feet of ground covered over with subsoil in one year by one Gopher.

Mixing the soil.—That Gophers have done great good in preparing the land for cultivation can not be denied. For unknown ages they have been steadily at work plowing the ground, covering deeper and deeper the vegetable matter, loosening the soil, draining the land, and slowly but surely cultivating and enriching it. On the prairies that are swept each year by fire, the only vegetation remaining to decay and fertilize the soil is that which the gopher hills cover and protect from the flames. On poor, sandy soil the scant vegetation would dry up, blow away, and only a small amount find its way into the soil were not the gophers busy all summer burying the fresh plants. Carefully scrape away a gopher hill that has been standing for six months and a layer of decayed plants will be found under it. In a year or two new plants will spring up on the spot and draw their nourishment from the elements of former growths, these again in time to be buried and add their substance to the wealth of the soil. Hence it would be well to examine their habits carefully before condemning the Gophers that occupy wild pastures and idle land.

Hibernation.—Although Gophers are supposed to hibernate, there is abundant evidence that they do not. While all hibernating animals become very fat in autumn, as a preparation for their long winter's fast, Gophers never undergo such a change. Moreover, during snowy winters when the ground is not frozen they continue their work under the snow. When the snow is light, hills may be thrown up under it in the ordinary way, but if it becomes too hard to be readily pushed aside, the animals excavate tunnels in it into which they push the earth. As the snow disappears in spring cylinders of packed earth are frequently seen radiating from the closed ends of gopher holes. They are sometimes 20 feet long. Throughout the northern part of the gopher country the ground usually remains frozen during most of the winter. Then the Gophers do not appear at the surface at all, but are probably extending their tunnels below the frost, where food is obtained from deep running roots. To what extent they depend on the stores laid up in fall is hard to tell. Part of the supply is sometimes used, but frequently the spring plowing turns out an untouched and moldy store left from the preceding year. Of course the supply of food encountered in extending their tunnels determines whether the stores shall be drawn upon.

Food.—The food consists chiefly of roots, tubers, and other rather hard vegetable substances, though grass and the succulent parts of plants are sometimes eaten. In agricultural districts the animals are highly injurious, destroying potatoes and other tubers in large quantities, and gnawing off the roots of fruit trees. When a burrow strikes the roots of a tree, it is carried around among them until one after another the smaller ones are cut off and eaten and the bark stripped from the larger ones so that the tree is almost invariably killed. If the tree is not large every root is sometimes cut off, and the first breeze tips it over.

Drink.—So far as known Pocket Gophers do not drink. Like other rodents of arid regions they obtain the necessary water from the plants on which they feed. Persons who have kept Gophers in confinement—Dr. Goode, Dr. Merriam, Professor Herrick, and Mr. J. B. Parvin—have never been able to make them drink.

Use of pouches.—Though their eyes are small and their range of vision limited, the Gophers lose little thereby in the dark underground passages. Touch, taste, and smell, take the place of sight as guides in selecting the roots with which they are constantly coming in contact while excavating their endless tunnels. They have broad, chisel-like teeth for cutting these roots, and large, fur-lined pockets in their cheeks in which to carry their food. Under cover of overhanging vegetation they fill these pouches with green leaves and stems to carry back and eat at leisure in their holes. In half a minute enough food for a good meal may be collected and stowed away, while a much longer time would be required to eat the same where collected. This arrangement is especially important to the Gophers from the fact that their sight is not keen. Probably their vision is better at night, or at least during the twilight, for then they are most active.

Chipmunks, squirrels, and ground squirrels take food in their mouths and with the tongue push it out between the teeth into an elastic pouch, just as boys put marbles in their cheeks. In the squirrels and chipmunks the cheek pouches communicate with the mouth. In the Pocket Gopher (also in all species of pocket mice and kangaroo rats) the pouches open from the *outside* along the front of the cheeks. They extend back under the skin to the shoulders, are lined with short hair, and are enveloped by muscles. The way in which Gophers fill their cheek pouches is thus described by Dr. Merriam in the technical paper already referred to:

> A live *Geomys* from Vernon, Texas, has been carefully observed for the purpose of ascertaining how the reserve food is placed in the cheek pouches. The animal soon became sufficiently tame to eat freely from the hand, and was commonly fed bits of

potato, of which he was particularly fond. The manner of eating was peculiar and interesting, and showed an ability to use the huge forefeet and claws in a way previously unsuspected. After satisfying the immediate demands of hunger it was his practice to fill one or both cheek pouches. His motions were so swift that it was exceedingly difficult to follow them with sufficient exactness to see just how the operation was performed. If a whole potato was given him, or a piece too large to go into the pouch, he invariably grasped it between the forepaws and proceeded to pry off a small piece with the long lower incisors. He would then raise himself slightly on his hind legs and hold the fragment between his forepaws while eating, for he usually ate a certain quantity before putting any into the pouches. If small pieces were given him he took them promptly and passed them quickly into the pouches. Some pieces were thus disposed of at once; others were first trimmed by biting off projecting angles. As a rule one pouch was filled at a time, though not always, and the hand of the same side was used to push the food in. The usual course is as follows: A piece of potato, root, or other food is seized between the incisor teeth, and is immediately transferred to the forepaws, which are held in a horizontal position, the tips of the claws curving toward one another. If the food requires reduction in size, the trimming is done while held in this position. The piece is then passed rapidly across the side of the face with a sort of wiping motion which forces it into the open mouth of the pouch. Sometimes a single rapid stroke with one hand is sufficient; at other times both hands are used, particularly if the piece is large. In such cases the long claws of one hand are used to draw down the lower side of the opening, while the food is poked in with the other. It is obviously impossible for the animal to pass food from the mouth to the pouches without the aid of its foreclaws.

The most remarkable thing connected with the use of the pouches is the way they are emptied. The forefeet are brought back simultaneously along the sides of the head until they reach a point opposite the hinder end of the pouches; they are then pressed firmly against the head and carried rapidly forward. In this way the contents of the pouches are promptly dumped in front of the animal. Sometimes several strokes are necessary. I am not prepared to say that the animal can not empty the pouches by means of the delicate investing muscles, but I have never seen them emptied in any other way than that here described.

The pockets are often stuffed so full of pieces of roots, stems, and leaves as to distort the appearence of the animal's head. Roots and stems are cut in sections about an inch long, so as to fit the pockets nicely, and are packed in lengthwise. Leaves are folded or rolled to fill the smallest space.

Although it is commonly supposed that the pouches are used for carrying dirt out of the holes, the fact is they are never used for this purpose. In examining the pockets of more than a hundred specimens caught in traps I could find no evidence that any had been filled with earth. Occasionally specks of dirt from roots cling to the hairy inner surfaces; nothing more. If the pouches had been filled with earth, the short hairs would inevitably retain some of it. Furthermore, Gophers shot in the very act of pushing dirt from their holes had none in their pouches. The method of removing earth from the burrows, as observed in live Gophers, has been already described (p. 11).

The Gophers are industrious workers, and whatever food is found and not needed at once is carried to chambers in some part of the tunnel and stored. Frequently a plow breaks into these storehouses and scatters their contents. Sometimes a peck of small potatoes, roots of coco grass, wild parsnip, wild sunflower, and other fleshy or bulbous roots are found in a single chamber.

Abundance.—Gophers are abundant over a large part of the Mississippi Valley, where I have estimated their numbers to be, in some places, three or four to the acre. This estimate will apply to considerable tracts of country throughout their range. In general they are most numerous on light, sandy soil. Farmers are sometimes of the opinion that Gophers injure their fields by bringing to the surface the bare clay or sand from below the reach of the plow. This may possibly be true in places where the soil is shallow and the subsoil poor, but they are, as already shown, more often a positive help to the agriculturist in mixing the soil.

Breeding habits.—Early in spring, before the snow is fairly gone, a male Gopher is sometimes found following a road or path. He has left his burrow and is seeking a mate. At this season a pair may be caught in one burrow, but at other times they are solitary. Apparently only the males leave the burrows in quest of mates, though positive information on the subject is difficult to obtain. The few that have thus come under my notice have been, without exception, males. The few facts known concerning the time of breeding and number of young are given under the head of the Prairie Gopher (*Geomys bursarius*).

Disposition.—In disposition the Pocket Gophers are naturally vicious. When caught in traps they fight with a ferocity that would be formidable in larger animals, and if nothing else comes within their reach they bite a steel trap with such force as to break off their teeth. They will bite through a heavy shoe with the greatest ease. They seem to have no sense of fear. The few that I have met away from their holes have, without any provocation on my part, attacked me with the utmost fury, as if bent upon killing and devouring me. They would bite at my feet or any part of my person that came within reach, all the time uttering a wheezy, panting sound, expressive of anger. Even the half-grown young show the same fierce disposition. No doubt they could be tamed and made gentle if taken when young, and might make as interesting pets as the one described by Dr. Merriam. Professor Herrick, speaking of one he had in captivity, says: "After a short time he became perfectly tame and an engaging pet."

My one effort at domesticating a Pocket Gopher was a failure, probably because the Gopher was old and hardened in his ways. He was placed in a large box in which a partition with a hole through it separated one-half, filled with dirt, from the other half, which was open. Plenty of food and nest material were placed in the box, but the Gopher paid little attention to them. His one effort was to burrow out of the box. Beginning at the hole in the partition he pushed the dirt through into the vacant side, then brought it back. The dirt was pushed, not carried in the pockets. For several days he worked almost incessantly, moving the dirt back and forth. He would sometimes stop and scratch or gnaw the wood, but to no great extent. He would eat raw potatoes when no one was near, but would stop eating or working to try to fight anything that moved within his range of vision. He always tried to bite when I stroked him, and finally, after he had succeeded in putting his teeth through the end of my finger, I gave him his liberty.

The fierce disposition is just what might be expected from the solitary mode of life. From the time the young are half grown and big enough to start burrows of their own, each individual lives entirely alone, except during the short mating season in early spring. Living alone and in the dark for eleven months of the year is not calculated to develop a lovable disposition. To the same causes—darkness and solitude—may also be attributed the Gopher's small eyes and ears, narrow brain case, and undeveloped voice.

Voice.—The usual hissing sound made when angry seems to have no connection with the vocal organs, but to be the result of rapid inhalation and exhalation through the half-open mouth. Perhaps the hairy lining of the mouth aids in producing the sound. When the Gophers are caught and held firmly in the hand, or in any way hurt, they sometimes utter a sharp squeal that expresses either pain or a climax of rage. It is rarely heard, however. In handling a large number of the animals alive I can recall but three instances in which they gave vent to this cry.

Mr. Edwin A. Donald, in an interesting letter on the Pocket Gopher, says: "I have killed scores of them, and the only outcry, when struck, that I ever heard was on one occasion, when the animal gave a faint squeak, like a mouse, but not so loud. All the others I have killed died silent."

GOPHERS AS AN ARTICLE OF FOOD.

Unless they are too small, there is no reason why Pocket Gophers should not be used as food. Their habits are cleanly and in no way objectionable. They are strict vegetarians. Sometimes, from eating onions, leeks, or other strong plants, their flesh has an unpleasant odor, but usually it is sweet and tender. Mr. H. P. Attwater, of San Antonio, Texas, writes the division that "the German settlers on St. Charles Peninsula, in Aransas County, Texas, used to eat the Gophers, and pronounced them excellent."

THE TEETH.*

Structure and manner of attachment.—All of the Pocket Gophers have the same number of teeth, namely, 20; 10 above and 10 below. There are 5 on each side of each jaw—a large cutting tooth in front (the incisor) and 4 smaller grinding teeth behind (the premolar and molars). All of the teeth are simple, rootless, tubular prisms, closed at the top and open at the base. In life the lower part is filled with a soft pulp-like substance, supplied with blood vessels which replenish the tooth from below, enabling it to grow as long as the animal lives. The hardening of the pulp within the tooth forms the dentine and osteodentine; the enamel and cement are deposited on the outside. In the adult the enamel is attached to the outside in the form of vertical plates or bands like staves on a barrel.

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* Abstract by Dr. Merriam of part of his article on the 'Dynamics of the Teeth,' from N. Am. Fauna, No. 8, 1895.

Each incisor is provided with a single band of enamel, which covers the front face of the tooth and forms the chisel-like cutting edge. The premolar has 3 or 4 plates. The true molars have 2 each in the genus *Thomomys*. In the genus *Geomys* the last upper molar always has 3 plates and the lower molars 1 each. The upper intermediary molars have 2 each in *Geomys*, but only 1 in Baird's Gopher (*Cratogeomys castanops*). The free ends of the enamel plates project slightly beyond the rest of the tooth, forming effective cutting blades.

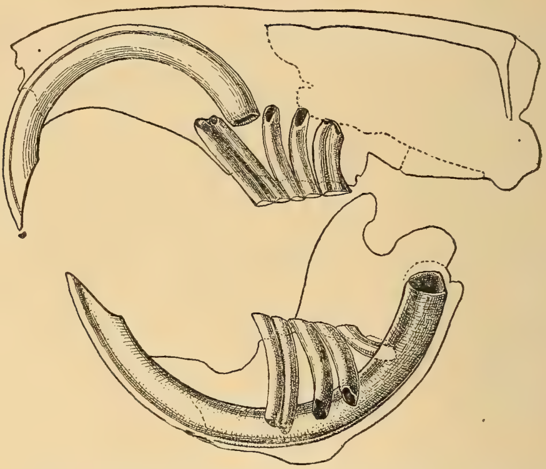
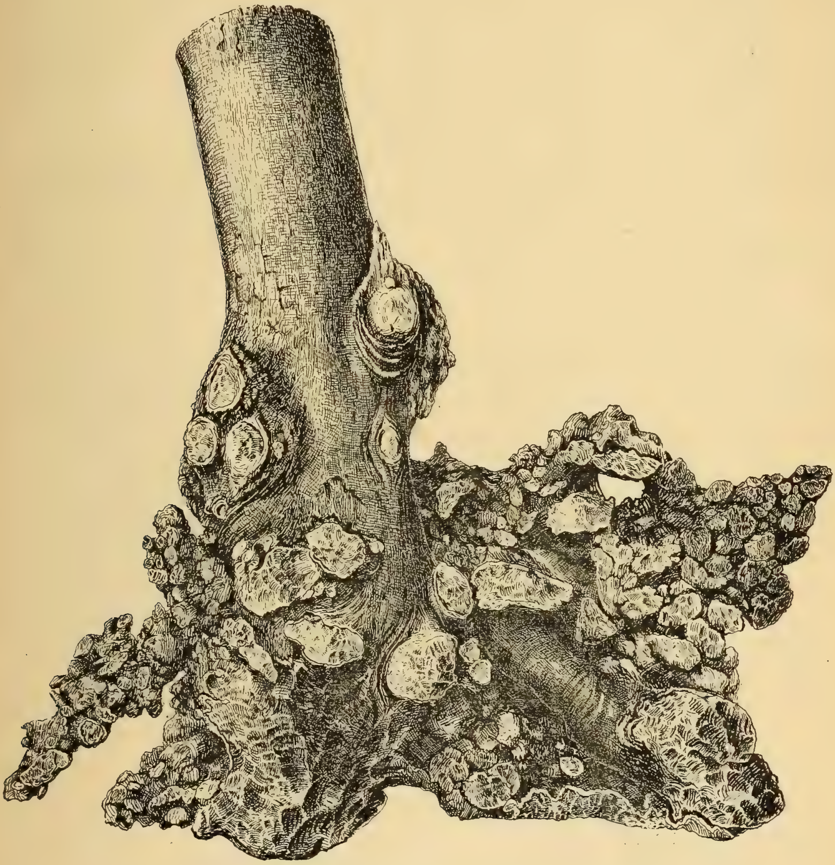


FIG. 4.—Outline of skull of Mexican Gopher, showing teeth in normal position.

All of the teeth are attached to the sockets by means of vertical cushions which extend from root to gum. This method of attachment not only relieves the tender pulp at the base of the tooth from pressure, but gives to the cutting edge an elasticity that is highly effective.

The teeth as a cutting machine.—The destructiveness of the Gophers in cutting and slicing roots may be better understood from a study of the machinery that does the work. The upper front tooth or incisor is used chiefly to anchor the animal to the root operated on, while the lower incisor does most of the work, playing rapidly back and forth like a steam drill until a piece is cut off and passed into the mouth, where it is planed or sliced into fine particles, ready to be taken into the stomach for digestion. The cutting edges of the enamel plates of the molar teeth are the tools that reduce the food. In the Gophers of the Mississippi Valley and Southern States, the plates are arranged in such a way that 38 distinct single cuts are made by the forward stroke of the jaw and 28 by the backward stroke. In a tame Gopher it was ascertained by actual count that 200 complete strokes are made each minute. On this basis the number of cuts made each minute on the forward stroke would be 7,600, and on the backward stroke 5,600, making a grand total of 13,200 cuts a minute while the jaws are in active operation.



IG. 5.—Root of apple-tree gnawed off by Pocket Gopher.

DAMAGE DONE BY GOPHERS.

Gophers injure farms in two different ways: By eating crops and by burrowing in hillsides, meadows, and the banks of artificial water courses. Full accounts of the damage done may be found in the special articles on the different species. Here it is necessary to mention the ravages in a general way only.

Injury to roots, tubers, and garden vegetables.—Gophers are especially fond of starchy, tuberous or bulbous roots like potatoes, turnips, carrots, beets, onions, and parsnips. These are cut below the surface and eaten on the spot, or carried away to be stored for future use.

Injury to other farm crops.—Certain crops, such as corn, wheat, oats, barley, rye, and alfalfa are cut above the ground and carried down into the burrows. Squashes, pumpkins, melons, and the like are sometimes gnawed into from below and the inside eaten out.

Injury to trees.—Gophers eat the roots of fruit trees and of trees planted for shade, ornament, or timber. Very great harm is done in this way. All the roots may be cut so that the tree falls at the first wind. The base of such a tree is shown in figure 5.

Mr. Byron Andrews, manager of the Boston Commonwealth, writes that at his farm in South Dakota Gophers have proved very troublesome in a 10-acre nursery of white ash trees five years from the seed. In one dry summer they cut away the roots of the young trees so that when touched the trees fell. "The Gophers would take every tree not missing one for ten or twelve feet in a row, and then cut across and go up the next row. In a few weeks they thus destroyed about one-half of the nursery.

Injury done by the burrows.—Gophers' burrows on hillsides often cause very serious washing in rainy weather. Meadows are damaged by the mounds of earth thrown out from the tunnels as well as by the tunnels themselves. Still greater injury is done by the burrows in the banks of canals and irrigating ditches. Thus, in about twelve years, a large irrigating canal nearly 25 miles long, at Riverside, Cal., became almost unfit for use on account of the holes bored in its banks by Gophers. In Weld County, Colo., suit was brought against the town of Greeley for damage done by the breakage of a canal caused by the burrowing of Gophers in the banks. One person secured a judgment of $750 on the ground that the town did not properly superintend the canal.

NATURAL ENEMIES OF POCKET GOPHERS.

From their manner of living below the surface of the ground and in holes carefully closed, Gophers would seem unusually safe from natural enemies. Compared with most mammals they are, but occasionally a fox or cat pounces upon one as it brings out a load of dirt in the twilight. Hawks and owls pick one up now and then and weasels often enter the burrows and dine upon the occupants. I have taken one from the stomach of a fox, while the stomach of a wildcat shot by Dr. C. Hart Merriam on San Francisco Mountain, Arizona, contained two.

As Gophers are most active during the evening and early night, more are captured by owls than by hawks. This is shown by Dr. A. K. Fisher, in his Hawk and Owl Bulletin, where it is stated that two were found in the stomachs of marsh hawks, four in red-tailed hawks, four in great horned owls, and eight in barn owls. The barn owl is especially serviceable in destroying Gophers. The following extract from a letter by Clark P. Streator gives important testimony on the subject: "In examining a large number of nests, at all months of the year, I have found nothing but Gophers [*Thomomys*], except on one occasion, when there were one or two Brewer's blackbirds. On further investigation I found a deposit of pellets of nothing but Gopher hair and bones, which had been ejected by the owls, and had accumulated in a few instances to the extent of two or three cubic feet in the trees in which the birds lived. I also found that in the breeding season it was not uncommon to find six or more Gophers, that were not eaten by the young, lying about the nest. I have found Gophers in the nests at other times than the breeding season, but not in such abundance."

In Arizona, a few years ago, I discovered numerous small bones on the bottom of a cave. They were the bones of rodents, and evidently had been brought by owls and disgorged as pellets. In about a quart of these bones were 43 skulls of the Gopher common in that locality. Nothing is known as to what owl inhabited this cave. Several are common in the region.

Mr. Ernest E. Thompson, writing of the Gray Gopher (*Thomomys talpoides*) in Manitoba, says: "The earliest seasonal record that I have for this species is as follows: April 12, 1883, 'Snowy owl shot by Mr. Arthur S. Thompson, and brought to me, had in its claws a pocket mouse,* whose pouches were full of roots.' Mr. Miller Christy writes me from western Manitoba as follows: 'May 5, 1887, found a nest of the horned owl (*Bubo virginianus*) in a poplar tree on the prairie. Besides the two fledgling owls, it contained the remains of 20 pocket mice* in various stages of decay.' The above is all the evidence I can give to show that the animal ever appears above ground."

Badgers spend much time and energy in digging open gopher holes, but rarely succeed in catching the Gopher. After digging far enough to convince themselves that the burrow is interminable they abandon the effort, and with better results turn their attention to ground squirrels.

There are two enemies that more than all others hold in check the increase of the Pocket Gophers—the weasel and the bull snake. Of these, weasels rank first, bull snakes (*Pituophis*) second. Whenever a weasel enters a gopher hole the Gopher is his prey. There is no possibility of escape. The largest weasel is small enough to enter their burrows easily and travel quickly through them. In localities inhabited by weasels I have found much difficulty, even when old gopher hills were numerous, in catching enough Gophers for specimens. Mr. L. C. Cummings, a well-known nurseryman of Riverside, Cal., writes: "At one nursery we were bothered with Gophers; all at once the Gophers became scarce, and from one to four weasels could be seen nearly every day running through the nursery and over an adjoining hill. They killed all the Gophers. We have a few weasels yet, but do not know how long they will stay. As Gopher exterminators they have done well."

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* Mr. Thompson uses the erroneous term 'pocket mouse' for these Gophers. Pocket mice are widely different animals and belong to another family.

Notwithstanding these facts weasels are almost universally condemned, and killed whenever opportunity offers.

The bull snake or gopher snake, which often attains a length of more than 6 feet and is heavily built, enters a hole that by accident may have been left open, and, following the Gopher to the end, swallows him. Mr. B. H. Dutcher, a field naturalist of the division, contributes an interesting account of a case that fell under his observation at Cairo, Kans. He says: "On going to my gopher traps one morning I found that one of them had been drawn 3 or 4 inches into the burrow. Taking hold of the chain I attempted to pull out the trap, but met with a steady resistance somewhat greater than that of which I considered a Gopher capable. Increasing the strain, the opposing force was suddenly removed and the trap emerged from the hole, with a dead Gopher in its jaws. On examination, the hind end of the Gopher for about half its length was found to be wet and covered with slime. Surmising 'snake,' I proceeded to my next trap, some 30 or 40 feet away, where I found that a similar tragedy had taken place. Here a large yellow bull snake (*Pituophis*), perhaps 5 feet long, had either pushed or pulled the Gopher from the hole some 2 or 3 feet, and had then proceeded to try to swallow him. He had succeeded in his efforts until the Gopher's neck was reached, where an unexpected obstacle was encountered in the trap, the jaws of which were tightly clasped just behind the head. When found, the snake was tying himself up into knots in vain endeavors to engulf the trap also. On my seizing the trap chain and trying to pull his prey away from him, the snake suddenly loosened his hold and quickly drew his head away from the Gopher."

In one instance only have I found a full-grown Gopher in the stomach of one of these snakes, but the fact that they habitually feed on them gives the snake its name. Notwithstanding the fact that these snakes are known to be perfectly harmless, most people kill them at every opportunity.

From time to time it is announced that Gophers may be killed or driven away by the use of a certain plant supposed to be poisonous or exceedingly distasteful to them. Wherever this plant is grown, Gophers it is said, cease their depredations. So important is this matter that it has been investigated by the agricultural experiment station of the University of California.

From this study it appears that the plant is well known in gardens, both here and abroad. It is cultivated on account of its ornamental flowers and fruit and is known as the giant spurge, false caper, or cross of Malta (*Euphorbia lathyris*). In parts of Europe the fruit is used for pickling. The spurge has a milky juice and is somewhat poisonous, serious sickness of children being caused by eating its attractive berry-like seed vessels. On the Gophers of the experiment station grounds, however, it had absolutely no effect, the animals thriving as well in fields where the spurge was grown as elsewhere. But the author of the bulletin, Mr. E. J. Wickson, states that the soil of the station garden "is a stiff adobe, and cases of success with the plant have been mostly reported from regions with sandy soils." (See Bull. 95, Calif. Agl. Experiment Station.)

METHODS OF DESTRUCTION AND EXCLUSION.

Bisulphide of carbon.—In most cases bisulphide of carbon is the simplest agent for the destruction of Gophers. It may be used as follows: Open the gopher hole where one of the freshest hills has been thrown out. Pour two tablepoonsful of bisulphide on a bunch of cotton, rags, tow, waste, or any such material and push it well down into the hole; then close the opening. The bisulphide quickly forms a heavy suffocating gas that flows down the hole and along the galleries. Whereever it overtakes the Gopher he is quickly killed. The whole operation is perfectly simple and easy. The only difficulty arises from the length of the tunnels, which is so great that the animals may be beyond the reach of the gas. Hence it is sometimes necessary to open the tunnel and introduce the bisulphide at two or more places.

The gas has a vile odor. It should be carefully kept from fire, as it is highly inflammable and explosive; otherwise no danger attends its use.

Fumigation.—Rude pumps, known as 'fumigators,' by means of which the fumes of burning sulphur may be forced into the burrows to suffocate the occupants, are extensively used in some parts of the West, particularly in California. They are, however, clumsy, expensive, and less effective than bisulphide of carbon.

Trapping.—Gophers are easily trapped, and once exterminated in a field, others do not soon come in. Their manner of traveling is so slow that only those near the edge of a field will work in during a summer. In the spring the males in their wanderings may settle down in a new place, but this does not often happen. The process of trapping is perfectly simple, although many farmers have assured me that Pocket Gophers can not be caught in traps. Hence a few directions may be useful. Having selected a fresh hill and observed from which direction the earth is pushed out, dig down on that side until the open hole is found. Enlarge the hole sufficiently to admit a No. 0 steel trap and remove such loose earth as may have fallen in. The trap should be set very lightly, placed well down in the hole, sunk in loose earth to the level of the runway, and partly concealed by a sprinkling of fine earth. Finding its hole open the Gopher proceeds to repair the breach, in doing which he steps on the trap and is caught. If loose earth is left in the burrow it will be pushed out in front of the animal, covering the trap, so that it will fail to spring.

Other methods of trapping Gophers have been tried with varying success, and numerous kinds of traps have been devised for the purpose. Five of these are figured in a bulletin of the Oregon Agricultural Experiment Station (Bull. No. 25, April, 1893). Many of them are clumsy and expensive, and few, if any, can compete with the common steel trap when the latter is properly used.

Poisoning.—Poisoning is a simpler and more expeditious method of destroying Gophers than trapping, but is more laborious than the use of bisulphide of carbon. The use of poison is always attended with danger, for in spite of all precaution, other animals than those for which it was intended are liable to get it.

The usual method is to insert a small quantity of arsenic or floured strychnine into a piece of potato and push the potato as far as possible into a fresh Gopher's hole and then close the opening securely. The Honorable J. Sterling Morton, Secretary of Agriculture, has found arsenic on white potatoes and apples efficacious in destroying Pocket Gophers at his home in eastern Nebraska.

Phosphorus has been used extensively in California, Washington, and Oregon in destroying ground squirrels, and to a less extent for Pocket Gophers. Mr. Allen Chattin, of Charter Oak, Iowa, states that he has entirely exterminated the Gophers from his own and several neighboring farms by the use of phosphorus. His recipe is as follows:

Put a stick of phosphorus in a 5-gallon can with a little cold water; next pour in hot water, not quite boiling, until the can is half full, and stir with a stick. When the phosphorus is melted add, while the water is stirred constantly, 2 pounds of sugar, and immediately after the sugar is dissolved thicken to a stiff batter with corn meal and flour, half-and-half. Now add wheat and stir until stiff. While adding the wheat add also 15 to 20 drops of oil of rhodium. The wheat will soak up all the water in the mass and it will become quite hard. Keep in a cool place. Small pieces may be chipped off as needed. Gophers may get too little strychnine to kill them, but no matter how small a piece of phosphorus they get it will finally prove fatal. Dig down to an open hole, drop in a small piece, put a clod to keep the hole from filling, and cover over with loose dirt to exclude the light.

It should be borne in mind that phosphorus is one of the most deadly poisons. I do not wish to be held responsible for recommending the use of this or any other poison on the farm.

Use of wire netting.—In Bulletin No. 5 of the Oregon Agricultural Experiment Station it is stated that young trees may be protected by a cylinder of wire netting 2 feet in diameter and 2 feet in length placed around the roots when the tree is planted. The top of the cylinder should be 4 to 6 inches below the surface of the ground, and the bottom may be left open. Netting with a three-quarter inch mesh is recommended.

Trenches.—It has been asserted that a field may be protected by a trench at the bottom of which oil cans are sunk at intervals. The Gophers in trying to enter the field are supposed to fall into the trench, along which they move until caught by the oil cans.

BOUNTIES.

So great is the harm done by Gophers that in many places bounties are offered for the animals' scalps or tails. Bounties have been paid most extensively in Iowa, North Dakota, South Dakota, and Minnesota, and from these States have been received detailed accounts of the results of the system. In these reports, however, the ground squirrels and Pocket Gophers are seldom discriminated, so it is hard to form a just estimate of the proportional sums paid for each. To give an idea of the large sums expended in attempts to reduce the numbers of these troublesome animals it may be stated that thousands of dollars are often paid annually by one county for this purpose.

The following table gives a detailed account of the sums expended in Gopher bounties by the State of Iowa, for which the best returns have been received (from county treasurers):

Table showing amounts paid in Gopher bounties in Iowa, by counties.

County.	Date.	Bounty on each Gopher.	Amount specified as paid for Gophers alone.	Total paid for Gophers and ground squirrels—not discriminated.
		Cents.		
Adams	1877-1880	$8\frac{1}{3}$		*$800.00
Carroll	1875	15		1,458.65
Do	1877	15		1,378.70
Cedar	None for 15 or 20 years			
Dallas	1868-69	10?		†440.00
Fremont	1888	5		*250.00
Do	1889			
Hancock	1888			†1,150.00
Humboldt	June 1, 1888, to July 1, 1888.	10		2,198.01
Do	1889	10		2,400.00
Ida	1871			10.99
Do	1872			35.84
Do	1873			90.50
Do	1874			126.25
Do	1875			71.58
Do	1876			225.79
Do	1877			371.01
Do	1878			994.29
Do	1879			73.00
Iowa	1889	15		*7,782.30
Do	Feb. 1, 1890	10		
Jackson	1867	15	$109.95	
Do	1868	15	1,176.80	
Do	1869	15	532.80	
Do	1870	15	177.25	
Do	1871		9.60	
Do	1872			*2,007.75
Lucas	No bounty for 20 years	10		
Mitchell	do			
Page	April 5, 1875	15	886.75	
Do	April, 1876	10	1,438.60	
Do	1877	10	2,785.95	
Do	1878		1,110.30	*6,221.60
Pottawattamie	No bounty for 10 years			

* Estimated. † Approximate.

Table showing amounts paid in Gopher bounties in Iowa, by counties—Continued.

County.	Date.	Bounty on each Gopher.	Amount specified as paid for Gophers alone.	Total paid for Gophers and ground squirrels—not discriminated.
		Cents.		
Ringgold		10		
Shelby	1870	10	$34.30	
Do	1871		481.50	
Do	1872		3.00	* $518.80
Tama	No bounty for 20 years			
Winneshiek	1887	5		
Boone	For 7 or 8 years previous to 1888.	10		
Franklin	1885	10		* 750.00
Do	1887			* 965.00
Do	1888			* 1,195.00
Do	1889			* 1,546.00
Buchanan	1868–1875	10		* 1,800.00
Johnson	No bounty for 20 years			
Greene	1869	10	337.10	
Do	1870	10	392.50	
Do	1871	10	256.80	
Do	1872	10	243.80	
Do	1873	10		* 1,327.80
Plymouth	1875–76	5		
Harrison	No bounty since 1874			
Marshall	1868	15		2,087.10
Do	866–1870	15		
Cerro Gordo	une 9, 1864, to Oct. 18, 1865.	10		* 954.45
Benton	1866	10	2,000.00	
Do	1867	20	10,000.00	
Do	1868	$12\frac{1}{2}$		
Do	June to December, 1868	10		* 1,800.00
Hamilton	1874 (?)			† 5,000.00
Madison	1864	$4\frac{1}{6}$		
Do	1865	$16\frac{2}{3}$		† 5,000.00

* Estimated. † Approximate.

OBJECTIONS TO THE BOUNTY SYSTEM.

The objections to the bounty system as a means of reducing the numbers of farm pests have been already stated in the publications of this division. The matter is of such importance, however, that certain facts of special interest in the present connection may well be repeated.

The experience of nearly all the States which have paid bounties for the destruction of injurious animals has been that the system is not only very expensive, but unsatisfactory. In the case of Montana the money in the treasury was exhausted before the act had been in operation six months, and yet the ground squirrels were not perceptibly diminished. The experience of Benton County, Iowa, with Pocket Gophers also shows the disastrous effects of offering high bounties. In 1866 a bounty of 10 cents per scalp was paid. The following year the bounty was increased to 20 cents, and amounted to $10,000. This caused the county to borrow $3,000, and still left Gopher warrants unpaid to the amount of $3,000 additional. The bounty was then reduced to $12\frac{1}{2}$ cents for six months, then to 10 cents, and was finally abolished on January 1, 1869, the entire amount paid out in three years being about $18,000; but the Gopher, although greatly reduced in numbers, was not exterminated.

The result was hardly more successful in the Dakotas and Minnesota, and in several cases the bounties were withdrawn within a few months after the passage of the law. The report received from Nelson County, N. Dak., showed that $4,363.25 had been paid for the destruction of spermophiles between April and July, 1887. The report states: "The attempt to put down the gopher raid was a failure, as it was impossible to follow the 1887 bounties without bankrupting the county. The county has 28 full townships and 227,000 acres under cultivation, which gives too much gopher lands." The county of Griggs, N. Dak., offered a bounty of 3 cents per tail for Gophers during the spring of 1887, and reported $5,200.60 paid out before the bounty was withdrawn. Mr. George R. Fralick, of Lamoure, N. Dak., wrote in 1888: "This county (Lamoure) has expended thousands of dollars to destroy the Gray Gopher, and there are thousands of them yet to destroy our crops."

In Minnesota, under the act of 1887, Meeker County paid bounties from May 1 to October 1, when the payments were discontinued, as it was said that there were as many Gophers as before, although $14,056.34 had been expended for the destruction of Pocket and Striped Gophers. In Nobles County the act of 1887 was accepted May 18, but the bounty was ordered discontinued after August 28. During this period the amount paid was $1,997.24, about 90 per cent of which was for Striped Gophers and the balance about equally divided between Pocket and Gray Gophers and blackbirds.

Several counties reported fraudulent payments of bounties. In Ramsey County, N. Dak., tails were received as evidence. This was unsatisfactory, as "it was proved that some of our clever young Americans divided the caudal appendage in two pieces and claimed bounty for each piece, or caught breeders, cut their tails off, and let them go, so as to give them a chance to raise more bounty-producing Gophers." The report from Madison County, Iowa, which offered bounties on the several species of Gophers indiscriminately, showed that bits of gopher hide with holes cut in them to imitate scalps were presented for payment. "This involved the county in lawsuits, and the bounty on scalps was repealed."

Dissatisfied with the effects of the bounty laws, the commissioners of several counties in North Dakota offered poison free of charge to the farmers for the destruction of Gophers. In the year 1888 Benson County distributed $100 worth of strychnine and reported the results satisfactory so far as the extermination of the pests was concerned, although some stock was poisoned. The number of Gophers killed during this year was said to be larger than during the previous year under the bounty act. In the spring of the same year Nelson County furnished $200 worth of the strychnine to the farmers, but reported the experiment unsuccessful. Wheat soaked in a solution of poison was used during May and June. These months were wet, and it was supposed that the moist ground destroyed in some measure the effects of the poison. During the years 1887 to 1889 Wells County furnished $500 worth of strychnine and reported the result successful.

In the State of Washington a large amount of money has also been expended in poison for the destruction of Townsend's Ground Squirrel (*Spermophilus townsendi*). Dr. J. W. Lockhardt, of St. John, Whitman County, under date of June 8, 1892, writes: "I think it no exaggeration to say that the farmers of this county (Whitman) spent $3,000 this year for the poison for this pest, and yet many acres of grain are already destroyed."

Evidently a bounty can be but a temporary expedient for the extermination of these or other animals. Even if a sufficient amount of money were appropriated to completely exterminate a species in a given locality, its numbers would soon be reduced to a certain limit where it would cease to be profitable to hunt the animals, and the bounty would consequently become inoperative.

Bounties offered for the destruction of harmful species seldom accomplish the desired end, and if success does finally result it is only after vastly larger expenditures than were at first thought necessary. After a harmful species—the wolf, for example—has become rather scarce in any section of country the offer of a bounty may lead to its complete extermination; and to attain such a result, it is certainly good economy to make the bounty large. Obviously, it is better to pay a large sum at once for the last few pairs of wolves in a district than to offer a bounty so small that it is little inducement to a hunter to spend his time in their pursuit. In this latter case the wolves easily hold their own for many years, or even increase slowly, while the aggregate bounties paid will far exceed all expectation. In order to be effective a bounty should be large enough to assure the destruction of the great majority of the individuals during the first year, and this is especially true of species which are very numerous and prolific. And yet the amount of money required for the payment of bounties in such cases would be so enormous as to make the plan impracticable.

A full discussion of this phase of the subject may be found in a section devoted to the question of bounties on the English sparrow.

GEOGRAPHIC DISTRIBUTION OF THE POCKET GOPHERS.*

The Pocket Gophers of the United States belong to three groups or genera which may be distinguished by the upper front teeth: *Geomys*, having two grooves on the face of each of these teeth; *Cratogeomys*, having a single deep groove, and *Thomomys*, having a single faint groove or none.

The area inhabited by the family stretches from the dry interior of British Columbia and the plains of the Saskatchewan southward to Costa Rica. In an east and west direction the group covers the continent from ocean to ocean, except that it is absent from the region north of the Savannah River and east of the Mississippi Valley. The family is clearly of Sonoran origin and reaches its highest development on the southern part of the table-land of Mexico. The great majority of the species inhabit the upper and lower Sonoran zones, though a few specially modified forms range upward on favorable mountain sides through the Transition and even into the lower edge of the Boreal zone. On the other hand, two species inhabit the Tropical belt of Mexico.

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* Abridged from a monographic revision of the *Geomyidæ*, N. Am. Fauna, No. 8, 1895.

The genus *Thomomys* has by far the most extended range of any of the three, inhabiting suitable localities from the Valley of Mexico and Mount Orizaba northward to British Columbia and the North Saskatchewan, and from the Pacific Coast eastward to the Great Plains. It is represented by numerous species.

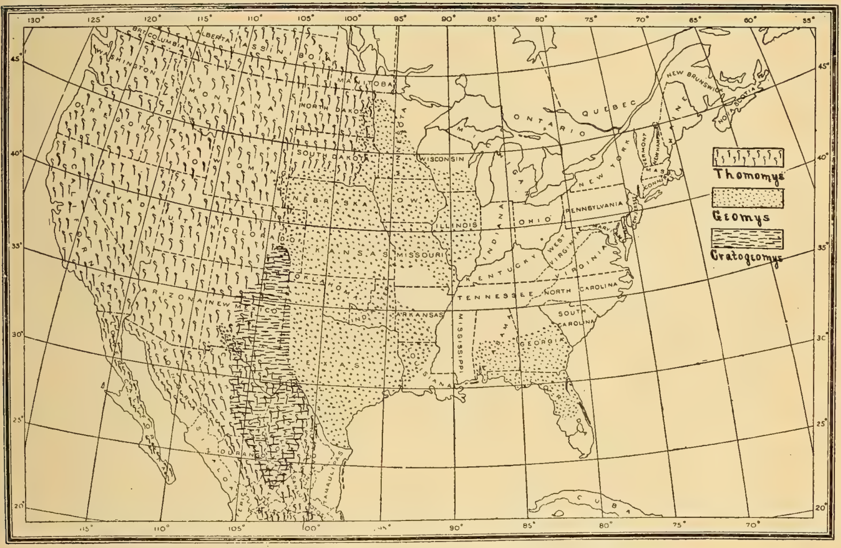
Thomomys
Geomys
Cratogeomys
130°
125°
120°
115°
110°
105°
100°
95°
90°
85°
80°
75°
70°
65°
60°
55°
45°
40°
35°
30°
25°
20°
Washington
Oregon
California
Nevada
Idaho
Montana
Wyoming
Utah
Colorado
Arizona
New Mexico
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Wisconsin
Illinois
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Georgia
Florida
North Carolina
South Carolina
West Virginia
Virginia
Pennsylvania
New York
Ontario
Quebec
New Brunswick
Cuba

FIG. 6.—Geographic distribution of Pocket Gophers by genera.

The genus *Cratogeomys* inhabits the Great Plains of the United States from the Arkansas River in eastern Colorado southward, and extends far into Mexico (see fig. 6 and map 1, H).

The genus *Geomys* inhabits a broad belt across the middle part of the United States from the Red River Valley in northwestern Minnesota and northeastern North Dakota southward to the Mexican boundary along the Rio Grande; and also the southern half of Alabama and Georgia and the northern half of Florida. It does not occur west of eastern Wyoming, east-central Colorado, and the Rio Grande Valley in New Mexico (see fig. 6 and map 1).

THE SPECIES OF GEOMYS.

The Georgia Gopher (*Geomys tuza*), a rather large cinnamon-brown species, inhabits the pine barrens of eastern Georgia, where it is locally known as the 'Salamander.' The same name is applied to the following subspecies:

The Florida Gopher (*Geomys tuza floridanus*) is a Florida form of *tuza*, as its name indicates, and does not differ materially in external appearance.

The Alabama Gopher (*Geomys tuza mobilensis*) inhabits southern Alabama and northwestern Florida and is a strongly marked form. It is very much darker than *tuza*.

The Prairie Gopher (*Geomys bursarius*) is the common Pocket Gopher of the northern Mississippi Valley, from eastern North Dakota and western Minnesota south to southeastern Missouri (see map 1, B). It is a dark liver-colored animal with pure white forefeet, in sharp contrast to the color of the surrounding parts, and has the longest claws of any of the species having two grooves on the upper incisors (see plate II).

The Plains Gopher (*Geomys lutescens*) is a pallid form of the *bursarius* type, inhabiting the arid sand hills of western Nebraska and extreme eastern Wyoming, and ranging thence southerly into northwestern Texas (see map 1, C).

The Louisiana Gopher (*Geomys breviceps*) inhabits the alluvial lands of Louisiana, Arkansas, and eastern Texas, the typical form coming from Prairie Mer Rouge, in Morehouse Parish. It extends thence northwesterly up the valley of the Arkansas River nearly to the Kansas border (see map 1, D). It is a rather small dark species. On the south, along the coast region of Texas, it splits up into the two following subspecies:

The Galveston Bay Gopher (*Geomys breviceps sagittalis*) inhabits the Gulf coast of Texas about Galveston Bay. It is smaller than true *breviceps*.

Attwater's Gopher (*Geomys breviceps attwateri*) inhabits the coastal plain and islands of Texas, from Nueces Bay northward to Matagorda Bay, and ranges into the interior nearly to San Antonio. It is considerably larger than typical *breviceps*.

The Texas Gopher (*Geomys texensis*) in its typical form inhabits central Texas (see map 1, E). On the north and northwest it probably passes into *lutescens*, while on the east it may intergrade with *breviceps*. It is much smaller than *bursarius* or *lutescens* and has a pure white belly. Its upper parts are reddish-brown, paler than *bursarius*, but darker and brighter than *lutescens*.

The Sandy Gopher (*Geomys arenarius*) inhabits a very restricted area in the upper Rio Grande Valley in extreme northern Chihuahua, western Texas, and southern New Mexico (see map 1, G). So far as known it is completely isolated, not coming in contact with any other species of the genus. It is of medium size, has a relatively long tail, and the upper parts are drab.

The Padre Island Gopher (*Geomys personatus*) inhabits Padre Island and the adjacent coast of Texas from Santa Rosa southward, extending inland as far as Carrizo, on the Rio Grande; its range, together with that of its subspecies *fallax*, thus coincides with the northern arm of the arid tropical belt along the Gulf coast (see map 1, F). In external appearance *personatus* much resembles *G. lutescens* of the Great Plains, from which it may be distinguished at once by its larger size, larger and more naked tail, and by important cranial characters.

Geomys personatus fallax inhabits a small area on the Gulf coast of Texas, immediately south of Nueces Bay. It is smaller and darker than true *personatus*.

HABITS OF THE GEORGIA GOPHER OR 'SALAMANDER' (*Geomys tuza*).

(Frontispiece.)

The Georgia Gopher inhabits the pine barrens of Georgia, and closely related forms are found in similar tracts in Alabama and Florida. The first description of the animal was written by a Member of Congress, the Honorable John Milledge, Representative from Georgia.

It was published by Dr. Mitchill in the New York Medical Repository in 1802 (Vol. V, p. 89), and runs as follows:

> One of the little animals that burrows in the pine land, only known in Georgia, was caught by Mr. Stephen Pierce, living midway between Savannah and Augusta. Its body is of the length and thickness of a common-sized rat, and of the same color; the head between that of a rat and a mole, with small whiskers and short snout; the tail without hair, but shorter than that of a rat; the forefeet like those of a mole, with nails near an inch long; the hind feet like those of a rat, but the nails not of the same length, each foot having five claws; very sparkling small eyes; also short ears; teeth like a squirrel, and full as long. On both sides of the jaw, externally, are sacks or wallets where it deposits its food, and each will contain as much as can be put in a large tablespoon. Little or no fur, and the hair of the length of a wood rat. The whole face of the pine country is covered with little mounds made by this animal, of the circumference of a peck, and from 6 to 8 inches high. It is by no means active, but remarkably fierce. No common wooden place of confinement can hold it long, as it gnaws its way out. It lives entirely on roots, and is very fond of the sweet potato, and often proves injurious to the planter by getting under his stacks. It appears to move nearer the surface in the spring and fall than at any other season. It is surprising that though the work of this creature is seen throughout the country, in the region of the long-leaf pine, and in that region only, yet such is its skill in burrowing, and acuteness of hearing, that there is no animal in all our State so seldom caught or seen.

The best account that has been written of the Florida Pocket Gopher is from the pen of the eminent director of the United States National Museum, Dr. G. Brown Goode, by whom it was contributed to Coues' monographic paper on the group, published in 1875. Dr. Goode kept a number in confinement for several weeks and was thus enabled to make the following interesting observations on their habits. He says:

> They may easily be confined in a wooden box, with sides 8 or 10 inches high, having dry sand 2 or 3 inches deep on the bottom. No cover is necessary; I have never seen one look up from the earth, and have rarely known them to attempt to escape. They require no water, and no food except sweet potatoes. A single potato of moderate size will feed a salamander for three days.
>
> The senses of sight and hearing seem in them to be very dull. An object may be held within a short distance of their eyes without attracting their attention; but

the moment one is touched, he turns with a jump, snapping fiercely, much to the detriment of fingers which may be near. If two are confined in the same cage, the one does not seem aware of the presence of the other, unless they accidentally come in contact. Their eyes are small, dull, and without expression. Their sense of smell I judge to be very delicate, from the manner in which they approach the hills of potatoes. Their motions are surprisingly quick and energetic, their activity never ceasing from morning to night.

They are very pugnacious, and a rough-and-tumble combat between two vigorous males would seem terrific, if their size could be magnified a few diameters in the eye of the spectator. Every muscle of their compact, elastic, stout bodies is brought into action, and they plunge and bite with wonderful ferocity. A battle is usually followed by the death of one or both. I have examined them after death and found the whole anterior part of the body bruised almost to the consistency of paste, the bones of the legs crushed in four or five places. When two come together in the cage their salutation is a plunge and a bite.

I watched their burrowing with much interest. They dig by grubbing with the nose and a rapid shoveling with the long curved forepaws, assisted by the pushing of the hind feet, which removes the dirt from beneath the body and propel it back with great power a distance of 8 or 10 inches. When a small quantity of earth has accumulated in the rear of the miner, around he whirls with a vigorous flirt of the tail and joining forepaws before his nose, he transmutes himself into a sort of wheelbarrow, pushing the dirt before him to a convenient distance, and repeating the act until the accumulation is removed, then resuming his mining Any root or twig which blocks his way is quickly divided by his sharp chisel teeth. * * * The direction of the burrows may easily be traced by the loose hillocks of white sand which are thrown up along the line at intervals of 3 or 4 feet. These are the 'dumps' made by the burrower in throwing out his refuse accumulations. Each consists of about a peck of loose sand, and, by the casual observer, might easily be mistaken for an ant hill. No opening is visible, but by digging under the hill a hole is found, the mouth of the adit to the main tunnel, which may be 3 feet below the surface if made in cold weather, but perhaps not more than 6 inches if in summer. One of the mounds is thrown up in a very few moments. I have seen thirty raised in a single night on the line of one tunnel; this would represent nealy 100 feet of tunneling. I have seen one hundred and fifty in one continuous row raised in about two days; this would make between 400 and 500 feet of burrow completed in that short time, apparently by one little animal, an amount of work which may seem incredible to one who has not watched the restless movements of these animated plows, which are seemingly as well adapted for piercing the sand as birds are for cleaving the air. The burrows are about 2½ inches in diameter. * * * The nests are large chambers, 1 or 2 feet from the main tunnel, with which they are connected by side passages, which leave nearly at right angles. Here the miners lay up a supply of provisions and the chambers are often found to contain a half bushel of sweet potatoes cut up into chunks as large as peach stones, and of convenient size to be carried in the pockets. * * * In these side chambers the salamanders rear their young, building a nest of grass, pine needles, and live-oak leaves. I found them breeding in April.

Mr. Morris M. Green, who obtained specimens for the division at Pomona, Putnam County, Florida, in June, 1889, furnished the following notes respecting their habits:

The hills of the 'salamander,' as the Florida *Geomys* is called, are abundant in the pine woods and clearings, on rather low and moist land. Their tunnels were from 4 to 24 inches below the surface; the hills were thrown up at intervals of from 2 to 6 feet, and contained about a peck of dirt each. The night and early morning seemed to be their favorite time for working. It is very easy to trap a 'salamander' when fresh mounds are found. By sweeping to one side the heaps of dirt, traces of the hole through which the earth was brought and its direction can be easily found. A minute's work with the spade will usually expose the tunnel lying to one side of the hill. Place a steel trap in the tunnel, and cover up the breach with a piece of pine bark or some palmetto 'fans.' If the breach is left open, the animals will carry dirt to shut out the light, and thus clog the trap, whereas if the opening is closed they will step in the trap and be caught. A break is often repaired within half an hour, or it may be left for nearly a day. In mending an opening it is astonishing how compactly the earth is packed; in one case an animal closed an opening so securely that the tunnel could not be found at all until another shaft was sunk in search of it.

A 'salamander' caught in a trap is a picture of fury and spite, biting at everything within reach of its jaws, and sometimes breaking its front teeth in venting its rage on the trap.

In the cheek pouches of one were some pieces of pine roots, and some grasses were found in the tunnels. The animals do serious injury to orange and pear trees by gnawing the roots. Sometimes the roots are gnawed off so completely that the tree can be pushed over with one hand. They also feed on sweet potatoes. But when an animal enters a garden or an orchard, and betrays itself by throwing up hills, there is no excuse for not ridding the place of it, as it may be easily caught in a steel trap. It is claimed that the 'salamander' works near the surface from September to March, retiring deeper in the ground during the hot season.

Mr. William J. Frank, of Cotton Plant, Fla., writes the division as follows respecting this Gopher:

> They are very common in this part of the country, and do considerable damage to vegetables, especially potatoes. They tunnel under ground, and following the rows eat the potatoes from the hills. Mr. Walter Scott, at Rock Springs, says he lost 20 percent of his sweet potatoes by Pocket Gophers last August and September. Pocket Gophers sometimes destroy fruit trees, shrubs, etc., by cutting off the tap-roots. During the past year several peach, plum, and orange trees have been killed in this section by them.

HABITS OF THE RED OR PRAIRIE GOPHER (*Geomys bursarius*).

(Plate II.)

The Prairie Gopher is of much greater economic consequence than all the other species combined, for the reason that its home is in the fertile prairie region of the Mississippi Valley from central Missouri northward, covering the whole State of Iowa, nearly the whole of Illinois, and the richest and most densely populated agricultural lands of eastern Kansas, eastern Nebraska, eastern North and South Dakota, Minnesota, and southern Wisconsin.

The statement so often made that Pocket Gophers are prolific breeders has no foundation in fact. Only one litter of young is raised in a year, and as there are but two or three in a litter the rate of increase is slow. Judging from available facts their birth rate is less than half that of the ground squirrels, tree squirrels, chipmunks, mice, and most other small rodents. On the other hand, their mode of life protects them from a host of enemies that attack animals of less seclusive habits. They are early breeders. A female collected May 14, 1886, at Elk River, Minn., contained two embryos; and on the same day a nearly half-grown young was caught. At the same locality on April 29, 1888, I found a young hardly one-third grown that had come out of the burrow during a cold rain and had been chilled to death. At Verdigris, Nebr., a female caught June 12, 1893, was nursing young. In southern Minnesota, in the latter part of May, my dog once dug out a nest containing two that could not have been a week old. They looked wonderfully like little babies. They had no visible hair, their complexion was a beautifully translucent pinky-white, their heads were round, and their little fat hands and fingers were touchingly babyish. Both eyes and ears were tightly sealed. They were helpless, and had the appearance of being born in a very rudimentary or undeveloped condition. The nest was a bed of soft grass and vegetable fibers on the bottom of an oval chamber in the burrow. Whether two is the usual number of young seems doubtful.*

Before the young are half grown they begin to run about in the burrow and strike off in side tunnels of their own. Sometimes they leave the parent burrow and begin a new one that does not connect with it. It is not uncommon to catch one when no more than half grown living in a burrow some distance from any other. Their hermit life has then fairly begun. By autumn they are practically full grown and have learned all the art of 'gopher mining.'

Numerous complaints have been received of the injury done to fruit and shade trees, hedges, and garden vegetables. On the prairies Gophers damage the groves of planted timber by gnawing the roots. They are especially troublesome in nurseries or wherever young trees are planted close together. Large trees are not often killed. Small ones are quickly ruined. The Honorable J. Sterling Morton, Secretary of Agriculture, states that on his farm in eastern Nebraska Pocket Gophers are particularly destructive to the horse-chestnut and ginkgo trees, gnawing off the roots in preference to those of other trees.

There is hardly a product of the garden or field that Gophers do not accept as food, but the starchy, tuberous, or bulbous roots are preferred to all else. Potatoes, turnips, carrots, beets, onions, and parsnips are favorites. Melons, squashes, and pumpkins are frequently gnawed and spoiled when a gopher hole happens to come up near them. Pumpkins and squashes are sometimes entered through a hole and the inside eaten out. It is not rare to find a gopher hole extending along a potato row and every hill entered and entirely cleaned out. Sometimes one row will be followed several rods and then another row attacked. One Gopher allowed in a potato field will do considerable damage and a larger number will easily ruin the crop. In fact, a number of cases have been reported where so much of the crop was taken by Gophers that the remainder was not considered worth harvesting.

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* In many animals the number of young bears a definite relation to the number of teats. All of the Pocket Gophers have 6 teats, 3 on each side—2 inguinal and 1 pectoral. The former are situated close together at the posterior extremity of the belly; the latter are on each side of the breast. The number indicates that three is the usual number of young, with a probable variation of from two to six.

Corn is rarely injured to any great extent, but the depredations in fields of small grain—wheat, oats, barley, and rye—are serious. From the time the grain comes out of the ground it is covered and killed by the gopher hills, and later, as the stalks become taller, they are cut down and drawn into the holes for food. The standing grain conceals the animals and their work. Long galleries are extended through the mellow soil close to the surface and frequent openings are made through which to come out to carry down a fresh supply of provisions. These shallow galleries are usually found packed full of cut up heads and stalks of grain—the remains of half eaten meals, and stores that have never been needed. While standing in the shock a small amount of grain is sometimes destroyed by the Gopher entering from below and cutting off the heads of a few bundles. If left standing for an unusually long time a shock is sometimes nearly destroyed. Occasionally they come up under a grain stack and in the same manner eat and waste considerable grain. Usually they do not care for ripe grain or seeds unless found in the sheaf or in a stack, where it is eaten along with stalks, leaves, and heads. They are particularly fond of half-ripe grain, which apparently is not shelled but eaten with the head and chaff.

They do their worst mischief in meadows. The leaves and roots of grass and clover furnish an abundance of food, but the amount eaten is of comparatively little consequence. Every hill thrown up covers and kills the grass where it lies, so that a single Gopher working all summer in a meadow will destroy the crop over a considerable area; but even this is not the worst result. The hills usually contain more or less gravel and in mowing with a machine the knife keeps running through them, dulling, nicking, and sometimes breaking the sections. It frequently becomes necessary to raise the cutting-bar several inches to avoid them, thereby losing a percentage of the crop. The surface of the meadow is made rough by the presence of the hills, and the horses feet frequently break through into the tunnels. This not only causes the horses to stumble, but increases the roughness of the meadow by leaving open holes.

Mr. John N. Houghton, of Grinnell, Iowa, writes: "The chief cause of damage is the throwing up of so much dirt on meadow land as sometimes to render it almost impossible to cut the hay."

Mr. W. Head, of Bristow, Iowa, writes under date of January 5, 1887: "The Pocket Gophers cover much ground with their mounds. * * * The damage done to meadow land is enormous, whole acres often being covered."

Mr. Allen Chattin writes from Charter Oak, Iowa: "At the edge of a stream I had a fine timothy meadow in which the Pocket Gophers got to work. At wet times I could not run the mower, because the soft hills which they threw up would clog the machine."

From Turlington, Nebr., Mr. William N. Hunter writes: "The Pocket Gophers (*Geomys bursarius*) are getting very numerous and doing great damage, especially to the meadows and mowing ground, where their mounds are a nuisance to the mowing machine. I have seen a string of mounds extend clear across a field of clover for nearly a quarter of a mile. They also do some damage to young orchards that have been sown to clover."

Mr. Peter Skoglund writes from Lake Andrew, Minn., under date of November, 1889: "Pocket Gophers do a good deal of damage to meadows by covering the grass with the earth they throw from their holes."

From London, Nebr., Mr. George A. Coleman writes: "Pocket Gophers are not particular as to their place of residence. They are found in orchards, meadows, and fields. They do great damage by burrowing and throwing up large hills, which are sometimes 4 feet across. I have seen them cover the ground so thickly that one could step from one hill to another. Let ten of them go to work in a 10-acre meadow and there would soon be very little grass left uncovered."

The above statement that gopher hills are sometimes 4 feet across, while correct, needs further explanation. It sometimes happens that the same hole is opened and dirt thrown out at different times until an unusually large hill is produced, the hole being stopped up during the intervals. The ordinary hills average 1 or 2 feet across.

Prof. L. L. Dyche, of Lawrence, Kans., writes:

> Pocket Gophers are common everywhere throughout this section of the country. There must be as many as one per acre, or even more in certain localities. Nurserymen and gardeners have the most complaints to make against this "very troublesome little animal," the principal of which may be summed up in the following manner: They do some damage to young hedgerows by burrowing under them and cutting off the roots and underground stems. As a rule the damaged places are but a few feet in length, but some instances have been noted where a third or even a half of the plants have been destroyed for a distance of 100 feet. This usually happens where the Gopher's course crosses and recrosses the hedgerow. Other kinds of trees are sometimes killed in a like manner in nurseries and a few in young orchards. Potato farmers, particularly those raising sweet potatoes, complain that the Gophers work destruction on their crops from the time they are planted until they are removed from the fields. In some sweet-potato fields which I visited places from a few feet to 2 or 3 rods in length were found in the rows where the Gophers had either killed the vines while they were young or had cut up and carried away most of the potatoes after the latter were formed. Winter before last a farmer 1½ miles north of Lawrence lost 35 bushels of sweet potatoes taken by Gophers from a cellar which contained 500 bushels. The cellar was dug in sandy soil in the edge of the field where the potatoes were raised. The Gophers entered at the bottom of the cellar under the edge of the boards which lined one of its sides. The cavity from which the potatoes were removed was 4 feet deep on the side where the Gophers entered and extended a considerable distance into the interior. The hole from which the potatoes had been removed was packed solid with earth. This hole was undoubtedly filled up with earth as fast as the potatoes were removed, for there was no external evidence by settling of the potatoes on the top of the pile of the mischief which was going on underneath. After the potatoes were removed in the early spring traps were set, and two Gophers (apparently all which had been working upon the potatoes) were caught. Several reports have been noted to the effect that from 1 to 15 bushels of Irish potatoes have been removed by Gophers from potato heaps (called 'potato holes' by farmers) buried in fields. Some damage reported to have been done to cabbage and various other garden plants by eating

off roots and stems, and then usually pulling the plant down into the ground. Gopher hills in meadows are considered a great nuisance by those who run mowers, but no complaints have been made of their injuring the meadows other than that a little grass or grain is covered up.

Dr. A. K. Fisher says: "Both at Storm Lake, Iowa, and Round Lake, Minn., complaints were made of the damage done by Pocket Gophers in gnawing off the roots of fruit and shade trees. Mr. Lounsbury showed me an apple tree, fully 6 inches in diameter, all the roots of which had been cut off by Pocket Gophers. He had lost upward of 100 apple trees in the past few years by these destructive rodents. Vegetable gardens also suffer severely from their depredations."

Mr. D. W. Lounsbury writes from St. Joseph, Mo.: "On the farm of a friend here one-tenth of an orchard of 18 acres planted last spring (1888) was destroyed by Pocket Gophers."

Mr. Henry I. Warden, Keosauqua, Iowa, writes: "They are very destructive to young orchards. I have lost a good many trees by their eating off the roots. * * * I have seen hickory saplings 2 inches through with the roots all eaten off by Gophers. * * * I have always paid 25 cents per head for all caught on my place."

Mr. S. S. Dickinson, of Larned, Kans., writes as follows of Pocket Gophers: "Late in the fall and in the winter and spring they eat apple and other tree roots. They have destroyed 200 apple trees for me in the past two years."

From Reeder, Kans., Mr. George Briggs writes: "They are destructive to fruit trees, running underground and cutting all the roots off. Five percent of all the trees in this neighborhood have been killed by the Pocket Gopher. * * * Last year we planted one acre in peanuts, from which we raised 100 bushels; 25 bushels were destroyed by Gophers."

From Louisburg, Miami County, Kans., Mr. C. H. Aiken writes: "The Pocket Gophers are destructive here and possess no redeeming traits. They are rather difficult to catch. They throw up mounds in our meadows and cut off roots of young hedges, grapevines, etc."

Dr. G. S. Agersborg writes from Vermillion, S. Dak.: "*Geomys bursarius* is very destructive and seems to work underground entirely, eating carrots, parsnips, and tree seedlings, especially black walnut, to within 2 inches of surface. They store away potatoes for winter. I know of one instance where nearly 2 bushels were found in the bottom of a burrow."

From Anthony, Kans., Mrs. H. C. Bowens writes: "Our experience has been that they eat roots and fruit and undermine vegetables. They ate our sweet potatoes and Irish potatoes about an inch under ground, leaving the tops to die."

Mr. Edwin A. Donnell, of Zumbrota, Minn., says in a letter of December, 1886: "One of my neighbors plowed out two bushels of potatoes which had been gathered in one deposit, and were as clean as if they had been washed." He also mentions another deposit in which a quantity of roots of quack grass and wild artichokes were found.

Mr. E. L. Brown, of Durand, Wis., writes under date of December 30, 1886: "Pocket Gophers are very injurious to grain, vegetables, and grass. I have seen as much as a half bushel of potatoes packed in a single hole. They sometimes come up under a pile of corn and carry it into the ground."

Mr. W. Head, writes on January 5, 1887, from Bristow, Iowa: "Two years ago, when I commenced to dig my potatoes, I found a great many mounds thrown up around and on top of potato hills; wherever I found these I did not find potatoes. The potatoes were often taken for a rod or more."

Mr. John N. Houghton, of Grinnell, Iowa, writes as follows: "*Geomys bursarius* is very common. He is very destructive to potatoes, and, in fact, to any garden vegetable growing underground, like carrots, parsnips, etc. I have plowed up half a bushel of wild morning-glory roots which he had stored for food, this being positive evidence in his favor."

Mr. D. W. Lounsbury, of St. Joseph, Mo., writes that nine-tenths of the potatoes in his garden were destroyed by Pocket Gophers.

Mr. H. J. Giddings, of Sabula, Iowa, says: "My experience with Pocket Gophers extends back to about 1867, when I commenced to trap them on my father's farm. At that time they were so numerous as to be a serious pest, doing great damage to meadows, young hedges, and orchards, and causing great damage by washing. This being a hilly country, the water following their runs started a great many ditches. I have known them to cut off 40 or 50 rods of hedge in a stretch, and have seen clover fields so full of their hills that the clover had to be cut several inches higher than usual to keep the machine out of the dirt. Now they are so few as to be of no concern. My farm contains 120 acres. Last year I caught one Gopher on it and one this year, to the present time, and to-day there is not one on the place. I believe the remedy to be for each farmer to catch the Gophers on his own place; that is the way we have done here. I can find no other cause for their great decrease."

Mr. George H. Berry, of Cedar Rapids, Iowa, writes of their destructive habits: "They injure grass crops by eating the bulbous roots of the coarser grasses, and by throwing up mounds of earth, thus annoying the mower and preventing the growth of grass for that season at least."

In an important paper on these animals, the late Robert Kennicott states:

> Wherever they exist on cultivated land, the Gophers are very injurious. No animal is more complained of by our prairie farmers. Scarcely a crop escapes their ravages. They are said to desert the wild prairie to inhabit cultivated hay fields; and they particularly delight in clover and timothy meadows. Here they not only do mischief by devouring the roots of the plants, but impede the mowing and rak-

ing of the hay by inequalities of surface caused by their mounds. Grain fields are much injured by them while the plants are growing; and when the stacks are left standing after harvest, the Gophers burrow from below, and frequently cut up and drag into their holes, or otherwise completely destroy, entire sheaves. All root crops suffer severly from them. In passing below the surface, they gnaw the bottoms of carrots, beets, turnips, and other tap-rooted vegetables, without disturbing the tops or coming above ground. In fields of common and sweet potatoes, they work under the hills and remove the tubers, and thus sometimes destroy half or more of the crop before the dying vines give evidence of the mischief. Instances are related in which potato heaps, covered with earth and left out during winter, have been entered by the Gophers and the tubers carried off. They sometimes enter melons, pumpkins, and squashes, through holes at the bottom, and eat out all the fleshy part, and then fill the hollow rind with earth, leaving it in a condition to create much astonishment when harvested. They also feed upon bark of the roots of trees, as well as upon the fleshy roots of herbaceous plants. Some of our prairie farmers are greatly injured by their destruction of Osage-orange hedges. No small item of their injury is the gnawing and cutting off the roots of fruit trees. A considerable portion of all the trees have been killed annually in some young orchards in Iowa and Illinois; and several fruit growers inform me that they have seen as many as a dozen large bearing apple trees killed by them in a single orchard. Forest trees, 6 or 8 inches in diameter, have died in consequence of their roots being cut. (Report of Commissioner of Patents for 1857, p. 76, 1858.)

Contents of seven stomachs of Geomys bursarius.

Catalogue No.	Sex.	Date.	Locality.	Percentage of animal matter.	Percentage of vegetable matter.	Contents.
22	♀	1887. May 28	Flandreau, S. Dak			11 large parasitic stomach worms; no food.
58	♀	June 10	Ortonville, Minn		100	Finely chewed roots.
59	♂	do	do		100	Do.
60	♀	do	do		100	Do.
69	♀	June 17	Fort Sisseton, S. Dak		100	Do.
76	♀	June 22	Browns Valley, Minn		100	Remains of roots.
122	♀	July 6	Travare, S. Dak		100	Finely chewed roots.

HABITS OF THE PLAINS POCKET GOPHER (*Geomys lutescens*).

The Plains Gopher, as its name implies, inhabits the semiarid plains instead of the fertile prairies. Its range is west and southwest of that of the Prairie Gopher, and it is not found north of southern South Dakota. It is common throughout the sandhills of western Nebraska and Kansas, and reaches into eastern Wyoming and Colorado. It is much paler than the Prairie species, its color closely matching that of the pale sand in which it is usually found. In habits it differs but little from the foregoing. Being considerably smaller, its burrows and hills are correspondingly smaller, so that in the western part of its range, where it meets the Gray Gopher (*Thomomys talpoides*), it is hard to tell from the size of the hills which species made them. On the contrary, the hills of the Gray and Prairie Gophers (*Thomomys talpoides* and *Geomys bursarius*) are easily distinguished by the difference in size.

In western Nebraska, where the light sand is constantly drifting into dunes and ridges that border the fertile valleys, the Gophers fairly revel. Nowhere else have I seen their hills so numerous. In places the ground is half covered with them. The mellow sand is easily moved and many hills are thrown up each night. As every hill improves the soil by burying vegetation, it is evident that the Gophers have been of inestimable benefit to the land.

But the Gopher fails to appreciate the rights of property, and refuses to keep on his own side of the fence. Marrowfat peas, lima beans, and red clover suit his taste just as well as the wild plants of the same family, on which he has dined for untold generations. The farmer quite reasonably objects to having his garden destroyed, his wheat buried, his potatoes eaten, and the roots cut from the trees he has planted for timber or fruit. Consequently a relentless war of extermination is declared and much hard feeling entertained toward the poor, short-sighted rodent.

In this species we have one instance in which the number of young in a litter is known. A female captured by me at Kennedy, Nebr., April 12, 1890, contained two small embryos. The only other Pocket Gopher in which the number is positively known is the Prairie Gopher, in which, as already stated, two young were found in a nest, and in another case two embryos were found. Audubon makes the statement that six to seven are produced at a birth, and Kennicott places the number at five or six, but both are apparently stating what they have heard at second hand.

In the case of the above-mentioned female at Kennedy, Nebr., the young would have been born near the end of April, probably by the 25th. In the same locality, two years earlier, I found young Gophers about half grown, digging holes for themselves by the middle of June.

HABITS OF THE LOUISIANA GOPHER (*Geomys breviceps*).

In 1855 Professor Baird described this Gopher from specimens collected at Prairie Mer Rouge, Morehouse Parish, La. For years no other specimens were collected, and a doubt arose as to the validity of the species. In 1892 I visited Mer Rouge, secured many specimens, and became familiar with the habits of the animal.

All over the small original prairie, now mostly occupied by fields of cotton and corn, this Gopher is common, but is most noticeable in pastures and along roadsides. Throughout the surrounding timber none were found except along the roads and in old fields, and on the hilly land a few miles back from the river no trace of them could be found. The colony seems restricted to the flat, mellow prairie, and is prevented from extending to lower land by annual floods. In the other direction its range is limited by clay hills and standing timber. On the south and east the Mississippi floods check it abruptly. On the west the black wax land of Texas—a soil in which no burrowing mammal lives—proves a complete barrier.

Compared with some other species of *Geomys*, they are not very numerous. At Mer Rouge in one pasture of 20 acres 15 'salamanders' were caught, and at least one remained. Though less than one to the acre in this pasture, each had produced a long line of hills to cover the grass and remain for a year or more as unsightly blemishes on an otherwise smooth surface of grass and clover. One line of 16 hills extended in an unusually straight course for a distance of 100 feet. An average hill measured 15 by 24 inches and 5 inches high. Usually there were one or two hills thrown up in a night by each Gopher. As a rule, where the ground is full of roots the Gophers do not dig so extensively as on poor soils where the food is scarce, but here they are able to carry on their work all the year round. Even at the low estimate of one hill per day, it may be seen that in the course of a year 365 hills would cover considerable ground, and with an average of but one Gopher to 2 acres they might still be a nuisance to farmers.

A slight loss is suffered from their work in fields of cotton and corn, but the complaints are mainly of their depredations in pastures, meadows, orchards, and gardens. Grass is covered and hills are left in meadows, the roots of fruit trees are cut, and garden vegetables eaten.

Another accusation brought against the Gophers is that they carry the roots of coco or nut grass from place to place, often bringing them from a roadside or waste place and storing a quantity in burrows in gardens or fields where they are left to grow. This coco grass is the most troublesome weed with which the Southern farmers have to contend. It spreads by means of long rootstocks on which small tubers are borne at frequent intervals. When separated, each of these tubers will start a new plant, which spreads rapidly and is exceedingly tenacious of life. On this subject Mr. J. Ernest Breda, of Natchitoches, La., writes: "The Gopher has of late years increased considerably in this parish, which fact I attribute to the scarcity of hogs running at large. In ante-bellum days planters were anxious to prevent the spread of the nut grass, or coco grass, and when they found plots 1 or 2 feet in diameter thickly set in this weed, where the previous year not a suspicion of its presence had existed, they at once concluded that some ill-disposed negro had intentionally set it there, and the suspected one was sure of punishment. I have demonstrated in a dozen instances that these coco roots were brought and stored by the Gophers. Last spring, seeing in my orchard two fine starts of coco, each about a foot in diameter, I carefully dug for the roots and found gopher holes terminating in each deposit. On a small rise of ground between the two I found the nest, containing three hairless young. While excavating for a fish pond I have found nearly a half bushel of coco tubers deposited 2 feet under ground and gopher holes communicating with them from all sides."

None of the farmers about Mer Rouge knew how to catch the Gophers in a practical manner. Some had wasted much time in trying to dig them out, and in pouring water into their holes in the vain endeavor to drown them. The ease with which a field was cleared of Gophers by means of a few steel traps astonished and delighted the residents.

Mr. G. W. Heard, of Creek, Calcasieu Parish, La., informs us that salamanders are numerous in that region, and that they do considerable damage to hilly land by cutting their tunnels about 6 inches under ground, causing the land to wash badly.

Mr. E. L. Cannon, of Loretta, in the same parish, says: "Salamanders are quite numerous all over Louisiana, with the exception of the marshy lands on the coast. They are troublesome and destructive on some farms, particularly to potatoes and gardens. In one fall and winter my boys caught 104 on a farm half a mile square with one steel trap."

In examining the contents of 27 stomachs the food was found to consist wholly of roots and green herbage. Clover seems to be a favorite.

We had five Gophers cooked for dinner one day and all of the four persons who ate of them pronounced them excellent. There was no bad flavor and the meat was sweet and delicate. As an article of food there can be no possible objection to them. Their diet is purely vegetable and their burrows are as fresh and clean as the newly-plowed soil from which come our turnips, beets, and potatoes.

Mr. H. P. Attwater has kindly contributed the following memorandum respecting the habits of *Geomys breviceps attwateri*, a subspecies of this Gopher, at Rockport, Tex.:

> As soon as the warm weather sets in, from about May to September, very few Gophers are observed working. The soil is sandy, and at all times damp, dampness known as "natural subirrigation." In the hot weather the dampness does not come as near the surface as in the cooler months. I have thought that perhaps the Gophers travel deeper in summer, but now think the chief reason why they do not throw up hills in summer, as they do in fall and winter, is that during the summer months the soil is so full of roots, suckers, bulbs, etc., that they do not have far to go before finding all they can eat, and that the reason they work so much after the summer months are over is because they are hunting around to find some bulb or root which was their favorite food in summer, and which they commenced to find about the month of May and was over with in September. The animals are very abundant all over the peninsulas in Aransas County wherever the soil is sandy. There is hardly a foot of land that has not been 'plowed' several times over by Gophers, and I believe the fertility of some sections has in this way been greatly improved. I have noticed that the richer the land the richer the Gophers. Of course they do considerable damage to vegetable crops, especially to young fruit trees and cuttings just rooting. The samples sent you of mulberry trees cut by Gophers were from the Faulkners' ranch, on St. Charles peninsula, in the eastern part of the county. Mr. Samuel Walker, the manager of the ranch, told me that he killed over 250 Gophers in his young pear orchard between the 1st of March and April 15, 1893. This orchard was set out where sweet potatoes had grown the year before, and they came up again and covered the ground, and I think the potatoes attracted the Gophers in the first place more than the pear trees.

HABITS OF THE SANDY GOPHER (*Geomys arenarius*).

So far as known this species is limited to the narrow strip of bottom land along the Upper Rio Grande Valley from El Paso, Tex., to Las Cruces, N. Mex., and on the Mimbres River at Deming. It is abundant in the mellow sandy soil of the fertile valley, where it is absolutely surrounded by hard stony mesas and desert mountains. Below this point the Rio Grande flows through a deep canyon with rocky walls and scanty soil, which does not afford a suitable channel for the Gophers to extend their range. Near El Paso they are especially troublesome on farms that are irrigated, and thus made to yield the largest crops, though wherever it is possible to turn the water into the burrows they can be driven out.

Mr. J. Alden Loring, who was sent to the Upper Rio Grande Valley to work out the range of this species, secured a large series from Las Cruces, N. Mex., and Juarez, Chihuahua, Mexico, as well as at the type locality, El Paso, Tex. Mr. Loring says: "They are not very common on the Mexican side of the river, but extremely so on American soil, where they seem to thrive and grow fat. The places they most prefer are railroad embankments and irrigation ditches, where they were found both in sand and wet, dark clayey soil. Two were seen on February 5 just as they protruded their heads from their holes. Their faces were covered with dirt, and as soon as they had shaken it off they saw me and quickly dodged back. When these Gophers were caught I noticed that they walked with the claws of the front feet partially doubled under, which did not allow the sole of the foot to touch the ground."

HABITS OF THE PADRE ISLAND GOPHER (*Geomys personatus*).

This is one of the largest Pocket Gophers of the United States. Large specimens of the Prairie Gopher (*Geomys bursarius*) nearly or quite equal it in size, though apparently the present species averages slightly larger. A specimen collected on Padre Island by Mr. Lloyd weighed 1¼ pounds, and measured from tip of nose to tip of tail 310 mm. (12.18 inches), and another still larger measured 320 mm. (12.63 inches). Of the prairie species the largest in a series of 70 specimens measured 311 mm. (12.25 inches). Several species of Mexican gophers are considerably larger.

Geomys personatus was described by Mr. F. W. True from two specimens collected on Padre Island, Texas. Later a fine series was collected on the island by a field agent of the division, Mr. William Lloyd, who furnished the following notes on the habits of the animal: "Common, principally about the center of the island, but extending clear to the north end. Apparently they do not occur for a distance of 20 miles along the southern extremity of the island. Some peculiarities of habit are necessitated by their environment. Living in the soft, loose sand, their holes might be easily broken into by predatory animals or washed open by rain but that the precaution is taken to pack them full of sand for a distance of 3 to 6 feet from the opening where the dirt is thrown out. Usually their burrows can not go very deep without reaching water, which was found standing in some of them. In no case did I find more than one Gopher in a burrow. They live in colonies, which are often a mile or more apart."

HABITS OF BAIRD'S GOPHER (*Cratogeomys castanops*).

This Gopher lives on the western part of the Great Plains south of the latitude of Las Animas, Colo. I have observed it in but one locality, Sierra Blanca, Tex., where it was living on the dry, gravelly mesa amid such desert plants as cactuses, mesquites, acacias, and yuccas. A preference for dry uplands appears to be characteristic of this species, as is further shown by the observations of Dr. A. K. Fisher, who furnishes the following note: "*Geomys castanops* and *Geomys lutescens* are about equally common at Las Animas, near Old Fort Lyon, Colo. The latter species is found mainly in the alfalfa fields, where the ground is kept wet by irrigation, though at least one specimen was taken in dry soil in close proximity to the other species. *G. castanops*, on the contrary, inhabits the dry, sandy mounds not reached by irrigation, and is most common in waste ground grown up with sunflowers, near railroads, and along the higher banks above the grassy bottoms bordering Purgatory Creek. They were difficult to capture on account of the dryness and looseness of the soil and consequent caving in of the burrows, caused by walking near where the traps were set. Six specimens were secured July 16–17, 1892."

HABITS OF THE GRAY POCKET GOPHER (*Thomomys talpoides*).

(Plate I.)

This species may be distinguished from the Prairie and Plains Gophers—the only species coming near it geographically—by smaller size, grayer color, slenderer form, and in all ages and conditions by the smooth front face of the upper incisors, which in *Geomys* are deeply grooved lengthwise.

The two animals are not known to occur in the same localities except along the eastern part of South Dakota and southeastern North Dakota, in which region their ranges meet and slightly overlap. Both have been taken at Portland, Traill County, and Valley City, Cass County, N. Dak.; and at Fort Sisseton, Marshall County, S. Dak. Why the two should not intermingle while separated by no apparent barrier is an unsolved problem in distribution. The separation does not appear to occur along any zonal line and can not be accounted for by difference in latitude, altitude, or humidity. Usually where their ranges meet there is a neutral strip between in which few, or none, of either occur. There are two possible solutions of the problem: Soil, and the dispositions of the Gophers. In South Dakota *Geomys* inhabits the mellow soil of the James River Valley and its western branches, while *Thomomys* inhabits the high rolling prairies with heavy, clay soil that is waxy when wet and hard when dry. Thus the two species come nearest together where sandy valleys penetrate the high prairie. That *Geomys* invariably avoids hard or stony soils is shown by its absence from south western Missouri and the Ozark Mountains; from the clay prairies of southeastern Kansas, and the wax lands of Texas. On the other hand, *Thomomys* delights in the hardest soils and stony mountain sides. Thus it is easy to account for the limit of range of *Geomys* by soil. But while *Thomomys* inhabits hard soils it does not object to sandy and mellow soils. The reason it does not invade the range of *Geomys* may be that the latter, being the larger and more powerful animal, will not permit it to occupy the same ground.

The Gray Pocket Gopher is abundant over nearly the whole of the great prairie region of North and South Dakota. The little mounds of fresh, black soil thrown up along its lines of subterranean tunnels show the various turns and windings of its galleries. Save for these mounds there is nothing to indicate the presence of the animal or its burrows. Often one individual works all summer without going beyond the limits of an acre of ground. It is rarely seen above ground, coming out of its hole just far enough to push back the loose earth brought from its excavations and quickly returning for other loads, until enough is ejected at one place, when it retires and closes the entrance of the hole with damp earth. The progress of the burrow seems to be wholly without aim or design, bending and turning in conformity to the character of the soil, or following such roots and plants as suit the animal's taste.

The burrows, nests, and mounds of this species and the Prairie Gopher are much alike except that the Gray Gopher, being a smaller animal, makes smaller burrows and throws up mounds more frequently. Usually after some familiarity with both species it is not difficult to distinguish the mounds. While *Thomomys* ordinarily produces small hills, it often forms large ones by reopening the same hole and throwing out additional earth. Sometimes the Gopher throws out fresh earth at the same place every night, closing the hole during the day, until a compound hill of considerable size is formed. Following are the dimensions of some hills that I measured at Pembina, N. Dak., in 1887: 4 by 4 feet in diameter and 10 inches high; 4 by 5 feet and 9 inches high; 3 by 3 feet and 7 inches high; 4 by 5 feet and 6 inches high. The ordinary hill is about 12 inches across and 2 or 3 inches high.

Near the large hills there are usually no small ones, but the tunnel extends a considerable distance before another hill is started. Twenty-seven feet is the greatest distance I have measured between two hills. The ordinary sized hills are usually 4 to 10 feet apart.

In habits the Gray Gopher is as solitary as the other Gophers.

Except during the mating season in spring it is rare to find more than one in a burrow, and the animals must live in absolute solitude throughout the greater part of the year. No wonder that they develop dispositions of unusual ferocity, and are always ready to fight any animal that comes in their way. When caught they become furious, biting the trap so violently as to break off their teeth, jumping about frantically, and giving vent to their anger in wheezing hisses.

On the prairies their food consists mainly of roots. Some green herbage is eaten, and more rarely, seeds. The roots of leguminous plants furnish the greater part of the food. The pulpy roots of the prairie clover (*Psoralea argophylla*) are eaten to such an extent that the flesh of the Gophers is often permeated with their peculiar odor. The turnip-like bulbs of another species (*Psoralea esculenta*) are esteemed a choice morsel, as are also the roots of wild liquorice (*Glycyrrhiza lepidota*). Many rattleweeds and the like (*Astragalus* and *Oxytropis*) that abound on the prairies furnish them food, while other plants known to be eaten are aster, blazing star, milkweed, wild parsnip, grass, and wild onion. The latter often imparts a rank odor to their flesh. It is doubtful if the root of any plant is rejected. Roots of shrubs and trees are eaten whenever encountered, but as orchards are rare where this particular Gopher is found, their depredations in this line are not often serious.

Further west other closely related Gophers of identical habits and mode of life do immense damage in orchards, cutting the roots from fruit trees and killing shrubbery. Their depredations are especially serious in the fruit regions of California, Utah, and Colorado. Near Pyramid Lake, Nevada, I have seen a small apple orchard in which half the trees had been killed in this way. Apparently there was but a single Gopher in this orchard, but as the ground was kept clear of other vegetation it had lived entirely upon the roots of apple trees. A dozen trees were already dead and others were dying. With one hand I tipped over several of the dead ones and found the roots cut off and gone, eaten or carried away, close up to the stump. Unmistakable marks of the Gopher's teeth covered the ends where the roots were cut and the animal's holes wound about the remaining stumps. These particular trees were from 2 to 4 inches in diameter and 8 or 9 years old. The base of one of them is shown in fig. 5 (p. 19). One hundred dollars would not cover the loss occasioned by this one Gopher.

The stomachs of 37 Gray Pocket Gophers have been collected by field agents of the Division of Ornithology and Mammalogy and preserved in alcohol for critical examination in the laboratory. The material had been so thoroughly masticated that very little could be identified save in a general way, and while the results are not of great importance they prove conclusively what has heretofore been considered probable, namely, that no insects or earthworms are eaten by the Gophers, and that roots form the bulk of the food.

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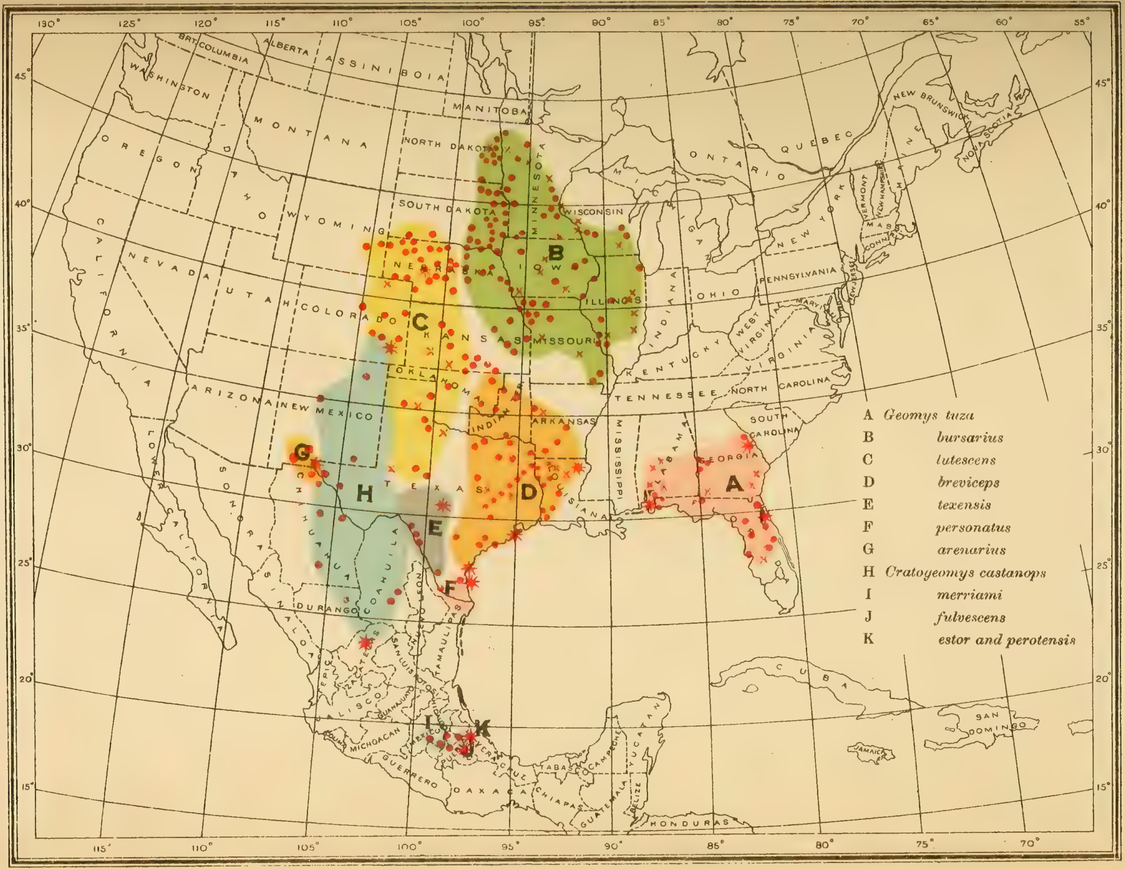
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MISSOURI
CALIFORNIA
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MICHOACAN
MEXICO
PUEBLA
VERA CRUZ
GUERRERO
OAXACA
TABASCO
CAMPECHE
CHIAPAS
YUCATAN
GUATEMALA
BELIZE
HONDURAS
CUBA
JAMAICA
SAN DOMINGO

DISTRIBUTION OF THE SPECIES OF *GEOMYS* AND *CRATOGEOMYS*.

Spots (●) = specimens in collection. Crosses (X) = records. Stars (✱) = type localities of species and subspecies.

BULLETIN NO. 6

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

THE COMMON CROW

OF THE

UNITED STATES

BY WALTER B. BARROWS AND E. A. SCHWARZ

GENERAL REPORT: WALTER B. BARROWS
REPORT ON INSECT FOOD: E. A. SCHWARZ

1862 1889

WASHINGTON
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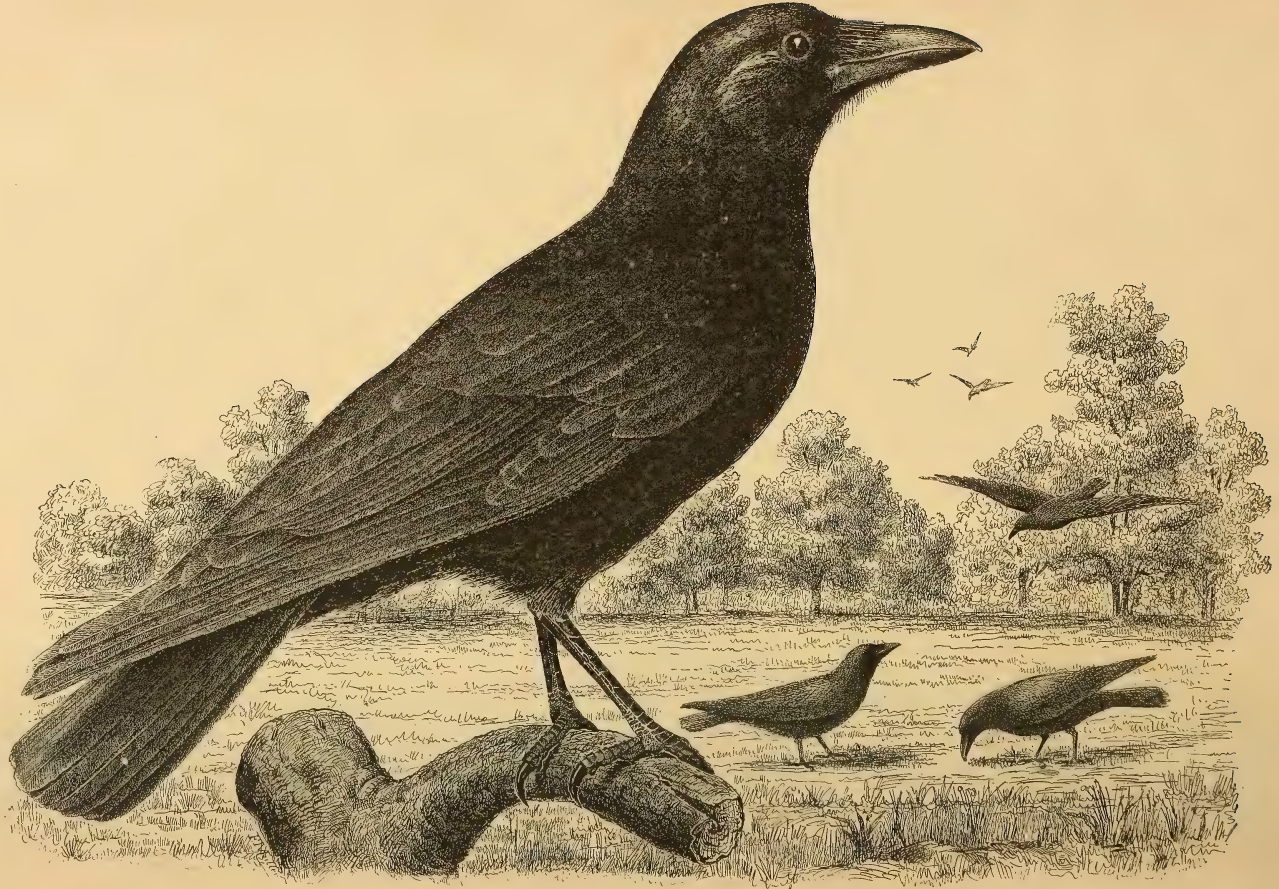

COMMON CROW, *Corvus americanus.*

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LETTER OF TRANSMITTAL

United States Department of Agriculture,
Division of Ornithology and Mammalogy,
Washington, D. C., July 27, 1895.

Sir: I have the honor to transmit herewith, as Bulletin No. 6 of this division, a report on the economic status of the Crow, by Walter B. Barrows, a former assistant in the division of ornithology, and E. A. Schwarz, an assistant in the division of entomology. Mr. Schwarz has prepared the part on the insect food; Professor Barrows all the rest.

The original manuscript was very much more voluminous than the present report. Hundreds of notes from observers and 86 pages of tabular matter, showing the principal contents of each of the stomachs examined, have been omitted. The detailed lists of insects found in the stomachs by Mr. Schwarz have also been left out.

The present report is based on the examination of the contents of nearly a thousand stomachs. The quantity and quality of the evidence seem sufficient to justify a final conclusion respecting the economic status of the Crow, although a larger number of stomachs from some parts of the country would have been acceptable.

The most important charges brought against the Crow are: (1) That it pulls sprouting corn; (2) that it injures corn in the milk; (3) that it destroys cultivated fruit; and (4) that it feeds on the eggs and young of poultry and wild birds.

All of these charges are sustained by the stomach examinations, so far as the simple fact that Crows feed upon the substances named. But the extent of the injury is a very different matter.

In order to ascertain whether the sum of the harm done outweighs the sum of the good, or the contrary, the different kinds of food found in the stomachs have been reduced to quantitative percentages and contrasted. The total quantity of corn eaten during the entire year amounts to 25 percent of the food of adult Crows, and only 9.3 per cent of the food of young Crows. Leaving the young out of consideration, it may be said that in agricultural districts about one-fourth of the food of Crows consists of corn. But less than 14 percent of this corn, and only 3 percent of the total food of the Crow, consists of sprouting corn and corn in the milk; the remaining 86 percent of the corn, or 97 percent of the total food, is chiefly waste grain picked up here and there, mainly in winter, and of no economic value.

In the case of cultivated fruits the loss is trivial. The same is true of the eggs and young of poultry and wild birds, the total for the year amounting to only 1 percent of the food.

As an offset to his bad habits, the Crow is to be credited with the good done in destroying noxious insects and other injurious animals. Insects form 26 percent of the entire food, and the great majority of these are grasshoppers, May beetles, cutworms, and other injurious kinds. It is shown by Mr. Schwarz that during the May-beetle season, in May and June, these beetles form the principal insect food of the Crow. Only a few stomachs do not contain them, and stomachs are often filled with them. The fact that the May-beetle season coincides with the breeding season of the Crow is of special importance, the principal insect food of nestling Crows consisting of these beetles. Mr. Schwarz also finds that grasshoppers occur in the stomachs throughout the year; that during the May-beetle season they occur in the vast majority of stomachs, but usually in moderate numbers; that with the disappearance of May beetles toward the end of June they increase in number until in August and throughout the fall they constitute by far the greater part of the insect food, often occurring in astonishing numbers, and often forming the only insect food.

To the same side of the scale must be added the destruction of mice, rabbits, and other injurious rodents by the Crow.

In summing up the benefits and losses resulting from the food habits of this bird, it is clear that the good exceeds the bad and that the Crow is a friend rather than an enemy of the farmer.

Respectfully,

C. Hart Merriam,
Chief of Division.

Hon. Chas. W. Dabney, Jr.,
Assistant Secretary of Agriculture.

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PREFATORY NOTE.

The present investigation of the food of the Common Crow was begun in 1885, and a general request for stomachs was made in the following year. A preliminary statement of the results of an examination of 98 stomachs—86 of the Common Crow (*Corvus americanus*) and 12 of the Fish Crow (*Corvus ossifragus*)—was published in the Annual Report for 1888, pages 498–535. The present report is based on an examination of the contents of 909 stomachs—nearly ten times as many as were available for the preliminary examination. The publication of the bulletin has been unavoidably delayed, mainly on account of the difficulty in obtaining Crow stomachs during the spring and summer months, but also because of the time necessary for a proper determination and study of the insect material. It is hoped, however, that the completeness of the investigation will atone for the delay.

Many of the notes and stomachs that have formed the basis of this report were collected by voluntary assistants in various parts of the country. To all these contributors we desire to extend our thanks. Nearly all the material, except the insects, found in the stomachs was examined by Prof. F. E. L. Beal, assistant ornithologist, under the supervision of the author. Dr. A. K. Fisher also rendered important assistance in identifying doubtful material, especially during the early part of the investigation. Further acknowledgments are due to Prof. C. V. Riley, formerly chief of the division of entomology, under whose direction the insect material was examined and reported on by Mr. E. A. Schwarz; to the late Dr. George Vasey, Botanist of the Department, and to his successor, Mr. F. V. Coville, and to other members of the botanical division, for assistance in naming seeds; and also to Mr. F. A. Lucas, of the United States National Museum, for the identification of many small bones and fragments, mainly of reptiles and batrachians.

W. B. B.

THE COMMON CROW OF THE UNITED STATES.

By WALTER B. BARROWS.

CHAPTER I.

GENERAL HABITS OF THE CROW.

GEOGRAPHIC DISTRIBUTION.

The Common Crow is generally distributed from the southern border of the United States north to about latitude 63°. It is abundant in the well-watered regions of the East, but in the West it is rare or local in the arid country, which comprises most parts of the Great Plains, the Great Basin, and the deserts of the Southwest from Texas to California. In southern Florida the Common Crow differs slightly from the northern bird, and is known as the Florida Crow. Four other crows and ravens are found in the United States. Along the Atlantic Coast from Long Island southward the small Fish Crow (*Corvus ossifragus*) occurs with the Common Crow, while on the Pacific Coast from Washington northward the Northwest Crow (*Corvus caurinus*) is found. The Raven (*Corvus corax sinuatus*) inhabits various parts of the United States. The White-necked Raven (*Corvus cryptoleucus*) is common locally in Arizona, New Mexico, and some other parts of the Southwest.

MIGRATION.

The fact that Crows are regularly migratory has been generally overlooked, chiefly because in most localities in the United States where Crows breed they are represented in winter by at least a few individuals. Even in Manitoba some may always be found in midwinter, and the same is true in parts of Minnesota and Wisconsin, and the entire northern tier of States. The great bulk of the species regularly moves southward in the fall and northward in the spring, the migration being as prompt and methodical as that of any other bird. It is probable, however, that few, if any, individuals migrate more than 500, or at most 1,000, miles. Crows as a rule get their food from the ground, and in journeying southward their principal object seems to be to reach a place where the snow does not cover the surface for long periods at a time, and where a fair amount of animal food is assured. While such conditions usually exist almost anywhere south of latitude 40°, the seashore and the banks of large rivers afford the best chances of obtaining a constant supply. Hence it seems probable that the great majority of Crows reared in the Northern States do not pass south of latitude 35°, but are concentrated at certain places, determined by the food supply, in the belt between the thirty-fifth and fortieth parallels. The great center of Crow population in the eastern part of this winter zone is in the neighborhood of Chesapeake Bay and its tributaries; a more western center is found near the junction of the Ohio and Mississippi rivers, while large numbers winter farther west, along the Arkansas and lower Missouri.

As usual with migratory birds, the northward or spring movement is more plainly marked, or at least more conspicuous, than the southward or autumn movement. In southern New York and Connecticut the spring migration often begins early in February, and by the latter part of that month or the 1st of March Crows in straggling flocks or singly appear in abundance all over New England and the Middle States. Occasionally the first arrivals come in flocks of many thousands, scattering to some extent to feed during the day, but collecting together to roost. More often the first migrants come in parties of a dozen or two individuals flying so far apart as to give the impression that each Crow is moving independently. In leaving winter quarters to move north in spring they depart in large flocks, and the same is probably true of the initial southward movements in the fall. These large flocks rarely if ever complete the journey with unbroken ranks, but divide and subdivide until in many cases the members arrive at their destination in small parties or even singly. Toward the close of each day's flight, however, single migrants show a decided tendency to unite with other stragglers, and these combined companies often reach some local Crow roost, where they pass the night with the Crows of the vicinity, or perhaps at a late hour rejoin the flock with which they started at daylight. Crows often fly until long after dark when they have a definite roosting place in view, but their migrations are performed mainly by day.

In the Middle and Southern States March and October are unquestionably the greater migration months for Crows, and under average circumstances the greater part of the movement takes place during the first half of March and the last half of October. This is shown by careful study of the dates of appearance at successive points in spring and fall and the increase or decrease at particular roosts.

CROW ROOSTS.

Crows are notoriously clannish birds, and except during a few weeks at nesting time are usually seen in flocks. Moreover, even while nesting they are more or less gregarious, for although two nests are seldom built on the same tree, yet half a dozen pairs often build within easy hearing distance of each other, and if one be disturbed all are likely to unite for common protection or protest. When the young are able to fly, the parents accompany them, forming little family parties of six or eight, and these soon associate with similar parties to form small flocks of twenty to fifty.

During migration, as already seen, Crows commonly travel in flocks of varying size, and in autumn they often congregate in large numbers, but only during winter do they unite to roost in immense communities. Many roosts are known where not less than 100,000 Crows spend the night during winter, and at some single roosts the number has been estimated to exceed 200,000. Most of these roosting places have been used year after year in the same way—the same individual trees for scores of years, and the same general locality probably for centuries.

Some of the roosts are in thick groves of pines or other evergreens, not necessarily large trees, but such as afford protection during storms; others are in deciduous trees (oaks, maples, poplars), while thick growths of willow and alders are chosen occasionally, and on the Delaware River Crows have roosted among reeds or coarse grass and brushwood overgrowing low islands. At a large roost on Arsenal Island in the Mississippi, near St. Louis, Mo., Mr. Otto Widmann found that "in ordinary weather the Crows roost on the trees of the island. * * * When the weather becomes severe, some of the Crows begin to pass the night on the sand bar, which at low water forms the western edge of the island, and when the cold becomes extreme all the Crows spend the night on the snow-covered bar or on the ice fields bordering it."

Whatever may be the nature of the place chosen, the Crows often begin to gather in the neighborhood several hours before nightfall, but do not actually settle upon the roost until it is almost dark. They begin to leave the roost soon after daybreak, scattering over the surrounding country to a distance of several miles.

In the latitude of Washington, D. C., and St. Louis, Mo., Crows begin to collect in some numbers at the roosts during the latter part of September, but it is probable that part of these Crows are transients which soon pass on to spend the winter farther south. About the last of October the roosts assume larger proportions, and Crows become very abundant in the surrounding country. By the end of November or early in December, in ordinary seasons, the winter roosts have attained their normal size, and it may be presumed the Crows occupying them are winter residents. All through the winter the numbers vary from several causes, the most important of which apparently is the prevalence of mild weather, during which many of the Crows form smaller roosts here and there, at a distance. During heavy gales, too, particularly if accompanied by rain or snow, belated detachments of tired Crows are very apt to settle in any convenient place when darkness overtakes them. Such temporary roosts are used at intervals all through the winter, but probably do not comprise 5 percent of the whole number of Crows in the neighborhood.

As already stated, most of the Crows inhabiting the northern half of the United States in summer are believed to pass the winter in a belt of country lying between latitude 35° and 40°. Within these boundaries or very close to them are located all the large winter roosts known to us.

The following is an imperfect list of all the large roosts known to be in use during 1886 and 1887:

List of the principal winter Crow roosts

Locality.	Extent.	Number of Crows.
New Jersey:		
Hainesport, Burlington County	20 to 30 acres	200,000-300,000.
Medford, Burlington County		Large numbers.
Tabernacle, Burlington County		Do.
Merchantville, Camden County	About 20 acres	200,000.
Reedy Island, Delaware River	About 50 acres	200,000.
Pennsylvania:		
Coatesville, Chester County	Several acres	
Davis Grove, Montgomery County	About 20 acres	200,000.
Lancaster, Montgomery County		Large numbers.
Maryland:		
Baltimore		Do.
Sandy Spring, Montgomery County	Small roost	10,000 (?).
District of Columbia:		
Washington (Arlington National Cemetery)	15 to 20 acres	150,000-200,000.
Indiana:		
Irvington		Large numbers.
Kentucky:		
Jessamine County		Do.
Illinois:		
Newman, Douglass County	Very large roost	
Missouri:		
St. Louis		70,000-90,000.
Pierce City	Large roost	
Nebraska:		
Peru, Nemaha County	do	100,000-200,000.
Kansas:		
Allen County	do	
Douglass County	do	
California:		
Posts, Monterey County	do	

In addition to these large roosts smaller ones have been reported from Syracuse, N. Y.; Amagansett, Long Island, N. Y.; Fishers Island, Long Island Sound; Middletown, Conn., and Wauwatosa, Wis.[1]

The immense winter colonies of Crows in the neighborhood of Chesapeake Bay early attracted the attention of naturalists, and both Wilson[2] and Audubon give graphic accounts of some of the large roosts known to them. But before their time the roosts had been carefully studied by Dr. Godman,[1] from whom the following quotation is taken:

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[1] Other roosts on the Connecticut River near Wethersfield, Conn., and on the Missouri River a few miles southwest of Kansas City, Mo., are mentioned by F. L. Burns, in Bull. No. 5, Wilson Ornith. Chapter, Oberlin, Ohio, March 15, 1895, pp. 7, 9.

[2] Wilson mentions roosts on the Hudson River 7 miles from New York City, and on the 'Pea Patch,' a small island in the Delaware River near New Castle, Del.—American Ornithology, Edinburgh ed., 1831, I, pp. 240-242.

"About the years 1800 to 1804, inclusive, the Crows were so vastly accumulated and destructive in the State of Maryland, that the government, to hasten their diminution, received their heads in payment of taxes, at the price of 3 cents each. The storekeepers bought them of the boys and shooters, who had no taxes to pay, at a rather lower rate, or exchanged powder and shot for them. This measure caused a great havoc to be kept up among them, and in a few years so much diminished the grievance that the price was withdrawn. Two modes of shooting them in considerable numbers were followed and with great success; the one, that of killing them while on the wing toward the roost, and the other attacking them in the night when they had been for some hours asleep. I have already mentioned the regularity with which vast flocks move from various quarters of the country to their roosting places every afternoon, and the uniformity of the route they pursue. In cold weather, when all small bodies of water are frozen, and they are obliged to protract their flight toward the bays or sea, their return is a work of considerable labour, especially should a strong wind blow against them; at this season also, being rather poorly fed, they are of necessity less vigorous. Should the wind be adverse, they fly as near the earth as possible, and of this the shooters at the time I allude to took advantage. A large number would collect on such an afternoon, and station themselves close along the footway of a high bank, over which the Crows were in the habit of flying; and as they were in a great degree screened from sight as the flock flew over, keeping as low as possible because of the wind, their shots were generally very effectual. The stronger the wind the greater was their success. * * *

"But the grand harvest of Crow heads was derived from the invasion of their dormitories, which are well worthy a particular description, and should be visited by everyone who wishes to form a proper idea of the number of these birds that may be accumulated in a single district. The roost is most commonly the densest pine thicket that can be found, generally at no great distance from some river, bay, or other sheet of water, which is the last to freeze or rarely is altogether frozen. To such a roost the Crows, which are, during the daytime, scattered over perhaps more than 100 miles of circumference, wing their way every afternoon, and arrive shortly after sunset.

"Endless columns pour in from various quarters, and as they arrive pitch upon their accustomed perches, crowding closely together for the benefit of the warmth and the shelter afforded by the thick foliage of the pine. The trees are literally bent by their weight, and the ground is covered for many feet [?] in depth by their dung, which by its gradual fermentation must also tend to increase the warmth of the roost.

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[1] Rambles of a Naturalist, Philadelphia, 1833, pp. 65–66, 103–125.

Such roosts are known to be thus occupied for years, beyond the memory of individuals; and I know of one or two, which the oldest residents in the quarter state to have been known to their grandfathers, and probably had been resorted to by the Crows during several ages previous. There is one of great age and magnificent extent in the vicinity of Rock Creek, an arm of the Patapsco. They are sufficiently numerous on the rivers opening into the Chesapeake, and are everywhere similar in their general aspect. Wilson has signalized such a roost at no great distance from Bristol, Pa., and I know by observation, that not less than a million of crows sleep there nightly during the winter season.

"To gather Crow heads from the roost, a very large party was made up, proportioned to the extent of surface occupied by the dormitory. Armed with double-barreled and duck guns, which threw a large charge of shot, the company was divided into small parties, and these took stations, selected during the daytime, so as to surround the roost as nearly as possible. A dark night was always preferred, as the Crows could not when alarmed fly far, and attack was delayed until full midnight. All being at their posts, the firing was commenced by those who were most advantageously posted, and followed up successively by the others, as the affrighted Crows sought refuge in their vicinity. On every side the carnage then raged fiercely, and there can scarcely be conceived a more forcible idea of the horrors of a battle, than such a scene afforded. The Crows screaming with fright and the pain of the wounds, the loud deep roar produced by the raising of their whole number in the air, the incessant flashing and thundering of the guns, and the shouts of their eager destroyers, all produced an effect which can never be forgotten by anyone who has witnessed it, nor can it well be adequately comprehended by those who have not. Blinded by the blaze of the powder, and bewildered by the thicker darkness that ensues, the Crows rise and settle again at a short distance, without being able to withdraw from the field of danger; and the sanguinary work is continued until the shooters are fatigued, or the approach of daylight gives the survivors a chance of escape. Then the work of collecting the heads from the dead and wounded began, and this was a task of considerable difficulty, as the wounded used their utmost efforts to conceal and defend themselves. The bill and half the front of the skull were cut off together, and strung in sums for the taxgatherer, and the product of the night divided according to the nature of the party formed. Sometimes the great mass of shooters were hired for the night, and received no shares of scalps, having their ammunition provided by the employers; other parties were formed of friends and neighbours, who clubbed for the ammunition and shared equally in the result.

"During hard winters the Crows suffer severely and perish in considerable numbers from hunger, though they endure a wonderful degree of abstinence without much injury. When starved severely, the poor wretches will swallow bits of leather, rope, rags, in short anything that appears to promise the slightest relief. Multitudes belonging to the Bristol roost perished during the winter of 1828–29 from this cause. All the water courses were solidly frozen, and it was distressing to observe these starvelings every morning winging their weary way toward the shores of the sea in hopes of food, and again to see them toiling homeward in the afternoon, apparently scarce able to fly."

In 1886 Mr. Samuel N. Rhoads contributed to the American Naturalist a valuable paper entitled 'Crow Roosts and Roosting Crows.' In most respects this paper gives a good idea of the character of these great roosts and their occupants. We must dissent, however, from Mr. Rhoads' opinion that "in winter a radial sweep of 100 miles, described from the city of Philadelphia and touching the cities of New York, Harrisburg, and Baltimore, will include in the daytime in its western semicircle fully two-thirds of the Crows (*C. americanus*) inhabiting North America, and at night an equal proportion in its eastern half." That the region described would contain more Crows than any similar area in North America is doubtless true, but it is now well known that this area by no means includes all the Crows reared in the Atlantic States, and probably none of those reared west of the Alleghanies.

Mr. Rhoads' account of the gathering of Crows at their roosts toward night and the manner of dispersal in the morning is quoted in full. He says: "A visit to one of the numerous roosts of New Jersey would repay anyone interested in nature and reward the curiosity of the most casual observer.

"The course adopted in assembling to and departing from the chosen spot is uniform everywhere. About an hour before sunset stragglers begin to appear, reconnoitering, as it were, to see that the coast is clear, and returning whence they came, as if to inform the main body of the result. In the course of half an hour the flocks begin to arrive in broken lines and detachments from all quarters, and, if the evening be calm, their earthward descent from a height of many hundred feet exhibits aerial prowess surpassing in daring elegance those of any other land bird with which I am acquainted. It is their invariable custom to descend to some spot in the neighborhood, from one-half to a quarter of a mile from the roost, preliminary to assembling there for the night's repose. This may be either upon the adjoining fields or on woodland tracts near by. Such preliminary gatherings, as Godman observes, seem to have a definite object—either for toilet or gastronomic purposes—a time, also, if we may judge by their clamor, of general conversation, some rejoicing, some repining, in their varied experience of the last twelve hours.

"The aerial evolutions of this descending multitude, coupled with the surging clamor of those which have already settled as successive re-enforcements appear, and which at a distance greatly resemble the far-away roar of the sea, may justly awaken emotions of sublimity in the spectator. To descend almost perpendicularly from a height of

1,000 feet above earth to the very tree tops and then to glide above them on half-closed wings with a resultant momentum that is almost startling in its arrowy velocity, is a favorite manœuver and when two such playfellows pursue each other in this headlong swoop their turnings and twistings and doubling contortions amaze the beholder. * * * Until sunset this novel scene continues without interruption, whilst field and forest in the vicinity of their great dormitories are shrouded by the thousands which have alighted; and were it not for the deafening clamor, the living pall which overspreads the scene might well suggest a land of mourning and death. When they settle on the ground on such occasions they resemble gulls on a sand bar, each standing motionless with its head toward the breeze. The whole thing seems unnecessary, as they mostly do nothing but cry out to their companions in the air and tumultuously applaud their hairbreadth escapes and feats of daring, yet sitting quietly until the setting sun warns them to make ready for the last act—going to bed.

"If we understood Crow language, perhaps we could now recognize a distinct signal from some grand master of their assembly, summoning all to repose.

"Be this as it may, a similar impulse now seizes the throng and the air fairly darkens as successive companies take wing and in silence betake themselves to the roost, flying low as if to avoid observation. Many Crows in approaching the place of preliminary gathering necessarily fly over the roost, but not a bird enters it until the general movement begins after sunset. The self-imposed discipline and obedience of such an army puts to shame the strictest military code. Think now of a miserable, weary Crow, which, having winged his way thither a distance of 20 miles, arrives about sunset at the roost; but the ingathering not having yet begun, witness how like a true soldier he flaps on to join his more punctual brethren who have settled half a mile farther off to gossip and plume themselves before retiring.

"On one occasion I observed large companies arriving in the roost near Merchantville, at a time of full moon, for nearly an hour after sunset. Between the intervals of arrival all would become quiet in their bedchambers, but, as a more belated company drew near, their cries were responded to by the roosting Crows in a different tone. The fliers would hurriedly ejaculate 'yur, yur, yur,' * * * giving each utterance a rising inflection, as if inquiring anxiously of their whereabouts, while those in the roost answered in a falling, drawling tone by slowly repeating their usual 'caw' and lengthening it to 'ca-aw,' 'ca-aw,' 'ca-aw,' as if to assure their friends they were resting comfortably. * * *

"The programme of dispersion from the roost in the morning to their feeding grounds is as follows:

"After an hour's babel (for such verily is the seeming confusion of tongues) a few Crows essay to take leave, but as soon as this folly is observed it literally 'brings down the house,' and when one imagines the simultaneous shout of 20 acres of Crows, one may not wonder that 'the house' is fully able to bring down the Crows. The few Crows resume their perches and comparative quiet is restored.

"Numerous attempts are thus made with a like result until nearly sunrise, when detachments of 500 to 1,000 successively take wing amid the wildest enthusiasm. These circle and wheel about in headlong swoops and elegant curves above the forest, and, each having taken his bearings, moves off in one of the many lines of flight that, eastward, westward, to north and south, extend from the common center as the spokes of a wheel.

"Ere the sun looks out upon the scene a silence almost oppressive broods over field and woodland, and to one who so recently beheld this departure, a scattered remnant of the mighty host only serves to heighten the feeling of contrasted desolation."

In 1888 Mr. C. L. Edwards,[1] then of the Johns Hopkins University, published the results of careful observations made on a large roost near the city of Baltimore. Perhaps the most valuable part of this paper is the attempt to estimate the number of Crows using this roost. Much difference of opinion has existed among observers as to the numbers resorting to any particular roost, the estimates for the same colony ranging all the way from 5,000 to several millions. It has been generally assumed that the numbers were much overestimated, since most attempts to number the birds have been scarcely more than guesses. Mr. Edwards' results may be accepted with some degree of confidence. He says:

"Seven miles southwest from Baltimore, a half mile southeast of Arbutus station on the Baltimore and Potomac Railway, is a tract of land of about a half mile square on which are several patches of woods which furnish the roosting ground for a winter colony of Crows. It seems from the testimony of the owners of this land that the crows have roosted there for about twelve years, having previously occupied a piece of woods a half mile or more to the westward, which they abandoned when housebuilding and woodcutting by the inhabitants made it undesirable. * * *

"A determination of the exact number of Crows here collected is not possible, but even the most sober observers place it among the hundreds of thousands. As a basis for an approximate calculation, I have made the following observations at the roost. With the aid of two friends, 15 different square rods, taken here and there at random, were paced off, and the number of trees thereon capable of furnishing roosting tops counted. An average gave us $9\frac{3}{5}$ trees per square rod. At any one roosting the Crows occupy about 10 acres (160 by $9\frac{3}{5}$ by 10), or 15,360 trees. If on each tree 15 Crows roosted—and that, if anything, is not too large an average—we should have 230,400 Crows in the colony.[1] Because of the dim light at sunset, my attempts at taking instantaneous photographs of the incoming streams of Crows were failures. A view, however, of one of the gathering flocks, taken about an hour before sunset, as it flew by in a straggling stream, shows 273 Crows in the photographic field. On this basis, the flying time (an average of a number of observations) for the bird to cross the field being fifteen seconds, in three streams coming in for one hour we should have 199,560 Crows. But the streams toward the middle and end of the incoming are manifestly much larger than the above, so this number may be taken as a minimum estimate."

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[1] Am. Journ. Psychology, I, May, 1888, No. 3, pp. 443, 453-454.

At various times I have made careful estimates of the number of Crows resorting to the roost in and near Arlington Cemetery, just across the Potomac from Washington. On one occasion it was possible actually to count all the Crows which had settled on one stretch of the sandy flats near the roost, and the number slightly exceeded 8,000. A much larger number were perched in trees and scattered over the surrounding fields, and large flocks were constantly arriving. Presently all or nearly all those on the flats took wing and joined the main body, yet the addition of these 8,000 Crows did not appear to increase the total number perceptibly. Subsequent examination of the woods showed that the colony occupied 12 to 15 acres. Counting 10,000 to the acre the total would be from 120,000 to 150,000 Crows. The most conservative estimate of the number roosting at any one point in that vicinity placed the number at 35,000.[2] Crows probably roost here and there in favored spots over a tract of country 7 or 8 miles long and perhaps a mile in breadth, but frequently the members of several of these roosts may unite for one or more nights, and in very stormy weather concentrate at some one point. Thus in visiting the Arlington roost at intervals of several days I was struck with the great difference in the numbers at the roost on different nights.

The following notes on Crow roosts illustrate the fact that these winter colonies are always essentially alike. Mr. W. P. Hay, writing the division under date of February 24, 1890, describes a roost near Irvington, Ind., as follows:

"For several years the Common Crow has been very abundant about here, especially in winter. Every morning at about half past 5 a great string of crows, extending as far as the eye can reach, can be seen flying toward the south. At about 4 o'clock in the evening they return. On the 15th of February I visited the roost, which is situated about 2 miles north of here. It is in a thick beech wood of perhaps 50 acres. I reached the place at about half past 4, and in a few moments the Crows began to arrive. They came in five 'streams'—from the north, northeast, northwest, south, and southeast. Soon the trees were black with them, and the noise they made was almost deafening. After being shot at several times they all congregated in one corner of the wood, and when shot at again left the trees and settled on the ground in the neighboring fields. They were now so badly scared that it was impossible to get within gunshot, so throwing myself on the ground to be as near as possible out of sight, I began to imitate as well as I could, the cawing of a Crow. Almost immediately they answered, and every Crow in the field came circling over me. At first they were perhaps 200 feet in the air. They all would caw as loudly as possible for perhaps a half minute, then they would be still. If answered, they would come lower and caw again. It was so near dark I suppose they could not see me, and at last they were within 20 or 30 feet of the ground. I shot and they flew away, but returned as soon as I began to imitate them again. At last they all departed for another woods."

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[1] It is difficult to realize the meaning of such a large number, and perhaps an illustration may help. It happens that if one Crow came in each second, day and night, it would require just sixty-four hours for this number to assemble.

[2] The number of Crows roosting in Arlington Cemetery during the winter of 1894–95 was very much reduced.

The following description of roosts in eastern Nebraska has been condensed from an article on this subject by W. Edgar Taylor,[1] of the State Normal School, Peru, Nebr.:

Some twenty-five or thirty years ago, in the early settlement of Nebraska, the Crow (*Corvus americanus*) was a rare bird, even on the Missouri, where now it is so very abundant as to attract the attention of the most careless observer. It is stated by many old residents that it appeared in eastern Nebraska about twenty-five years ago, and at the same time the Raven (*C. corax sinuatus*) and the Magpie (*Pica pica hudsonica*) began to disappear, and that the Crows have been increasing continually since. It has been their habit about the last of September to select some suitable point for roosting, usually some grove of willows on an island in the Missouri. This roost is retained till about the first of May, when they again disperse till the coming September or October.

I have observed their habits at a roost near Peru, Nebr. The principal part of this roost is on McKissicks Island, on the Missouri side of the Missouri River, about 2 miles above Peru. Another roost exists on Hogthief Island, some 5 miles above Peru, as well as a smaller roost on the Nebraska side of the Missouri River, about a mile above Peru. Another roost is said to exist 10 miles north of Hogthief Island, and we have reason to believe that others will be found along the river within the State.

All the roosts in Nebraska, so far as definitely known, are in willows large enough to sustain the weight of the Crows. We have heard of several roosts thought to be in oaks and other trees.

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[1] Annual Rept. Nebraska State Board Agriculture for 1887, pp. 119–120.

We believe that not less than 50,000 Crows frequent the roosts above mentioned, the extent of which is estimated as follows: Roost 1 mile north of Peru, 2 to 3 acres; Hogthief Island, 4 to 5 acres; McKissicks Island, 15 to 40 acres.

Of the various Crow roosts on record, the lowest estimate of Crows per acre is 5,000, and with this as a basis the lowest estimate on the three roosts near Peru would be over 100,000.

Why the Crows flock to these places to roost we can not explain. From a somewhat careful investigation we are confident that many of the birds make a journey of 40 to 50 miles and return each day. From daylight to sunrise on a bright morning they may be seen flying in long flocks in various directions from the roost, only to begin their return about 3 p. m., and they keep coming in until dark, and sometimes later. Before retiring for the night they collect on sand bars along the banks of the river, where they remain until about dark, when they rise in flocks and fly to the roost. Many play along the river and are overtaken by darkness while 5 or 6 miles away, but they invariably come to one point on the river before taking their night's rest. The noise made in taking flight for the day's journey has been heard 3, 4, or even 5 miles, depending on the condition of the atmosphere.

About the 1st of May these roosts are completely deserted. Where do the Crows go? Many breed in the neighborhood, and their nests have been found by students of the State Normal School; but from what we have been able to gather there are not Crows enough breeding in eastern Nebraska, western Iowa, and northwestern Missouri to account for all the Crows roosting on the Missouri during winter.

Mr. George A. Coleman, of London, Nebr., wrote in July, 1888, concerning these same Crow roosts: "During the winter they have their roosting places along the Missouri River and on the islands. The favorite roost is on Hogthief Island, which is about 6 miles above Peru, Nebr. Here from October until March they come to roost every evening, and from about 4 o'clock p. m. until 6 a constant stream of them can be seen coming from every direction, and the noise they make is deafening. At daybreak they scatter to the adjacent feed lots and fields, only to return in the evening. The number that roost on this and adjacent islands is estimated to be 100,000, and they are steadily increasing."

A roost is thus described by Mr. S. S. Rathvon[1] in Lancaster County, Pa.: "We have now a formidable Crow roost on the Conestoga, in this county, about 6 miles south of Lancaster City, but with their usual cunning I have not yet learned that they 'tease sheep near home.' The gentleman upon whose farm the 'roost' is located says they rise up every morning, and after forming four divisions, the one flies east, another west, another north, and another south, returning again in the evening. About the same number fly in these same directions and about the same hours every day."

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[1] American Naturalist, III, 1869, pp. 102–103.

Mr. J. Ellis McLellan, a field agent of the division, discovered a large Crow roost on one of the tributaries of the Big Sur River opposite the little settlement known as Posts, in the redwoods of the Santa Lucia range, south of Monterey, Calif., in March, 1894. Mr. McLellan states that the Crows in coming to this roost never come from the south, which is a mountainous wilderness, but from the north, where there are settlements and food.

WHY DO CROWS ROOST IN COMMUNITIES?

Much speculation has been expended in attempts to explain the object of these gatherings of Crows. The theory that they thus escape the attacks of some of their natural enemies fails from the fact that Crows have very few natural enemies—practically none except a few hawks and owls, and these probably are attracted rather than deterred by the presence of numbers.

Whether the large owls actually visit the roosts at night and feast on the sleeping Crows we have no means of knowing, but it is certain that during the day, when all the able-bodied Crows are absent from the roost, several of the larger kinds of hawks prowl about the vicinity and pick up the weak or disabled individuals which remain.

If Crows seek immunity from man by roosting in flocks, they must be sadly disappointed, for such gatherings are often looked upon as nuisances which should be promptly abated, and sometimes, as stated by Godman, they have been the scene of unprecedented slaughter. Yet even when driven away night after night the crows continue to return with the utmost persistency, and though they may change the roosting place temporarily, they are pretty sure to come back to it sooner or later. If the places selected were always well sheltered, or the trees afforded specially good perches, some conclusions might be drawn from these facts, but such is not the case. Many of the roosts, it is true, are in thick pines, but by no means all. Sometimes oaks and maples are chosen, sometimes cottonwoods or willows, sometimes beds of reeds, or even the bare ground on the surface of snow or ice. Godman supposed that the birds crowded together for warmth, and even suggested that the decomposition of their accumulated droppings would add to the heat. It may be asserted confidently that there is nothing in either of these ideas. The most probable explanation is found in the social nature of the Crow, which is conspicuous at all seasons.

DEPOSITS AT CROW ROOSTS AS EVIDENCE OF THE CHARACTER OF WINTER FOOD.

The Crow is one of the most omnivorous birds, and its digestive system is well adapted to the utilization of almost anything containing nutriment. Unlike the gallinaceous birds it has no true crop, yet it undoubtedly carries food in its distensible gullet when feeding its young, and at all times it swallows immense quantities of gravel or sand to aid in grinding up hard food in its gizzard-like stomach. Ordinary fowls which utilize hard substances in this way retain particles of sand or gravel until they are worn to powder, or at least have lost all sharp edges and corners, when they pass off through the intestines, fresh supplies being taken from time to time. Crows, on the contrary, eat large quantities of sand and gravel whenever their food demands it, and so soon as the trituration of this food is complete the sand and pebbles are expelled by the mouth, together with any indigestible substances of which the bird wishes to rid itself. All birds of prey are known to eject similar masses of undigested material, such as bones, hair, teeth, scales, and bits of shell, while some other birds, as kingfishers and flycatchers, have similar habits. These birds, however, swallow no sand or other hard matter to assist in grinding the food, and hence the ejecta, commonly called 'pellets' or 'castings,' consist entirely of the less digestible parts of the food.

Crow stomachs that do not contain some sand or gravel are rare at any time of year, and during the colder months when hard food enters most largely into the diet, the quantity of grinding material used every day is enormous.

On visiting a Crow roost for the first time one can not fail to be impressed by the great quantity of refuse food and sand scattered about. At the large roost in Arlington National Cemetery, Va., just across the Potomac from Washington, the deposit which covered the ground late in the winter of 1886–87 appeared at first glance to consist entirely of four substances: (1) Hulls of Indian corn in greatest abundance; (2) seeds of various kinds, mainly poisonous and harmless species of *Rhus*, with a considerable number of seeds of flowering dogwood, sour gum, and a few other species; (3) sand and gravel in large amounts; (4) the chalky excrement which matted together and more or less obscured the other components of the deposit. After heavy rains or melting snow the soluble excrement very largely washes away, the sand settles down to the lowest layer, and the surface appears to consist entirely of seeds, hulls of Indian corn, and some of the coarser gravel, particularly bits of coke, charcoal, brick, and shell. Of course other materials enter into the deposit, but those mentioned are the most conspicuous. At this roost I was seldom able to find any entire 'pellets' or 'castings'—doubtless because the Crows roosted well up in the tops of young and thickly branching trees, so that the pellets were broken to pieces by the fall or by striking on twigs and branches in the course of their descent.

The first perfect specimens of Crow 'pellets' seen were sent us by Mr. Otto Widmann, who collected them from the shores and ice of Hospital Island, in the Mississippi River, near St. Louis, Mo. Subsequently many such pellets were obtained from caged Crows kept during an entire winter; and still later other pellets were sent us from roosts in Pennsylvania, Indiana, and Kentucky. The usual size and appearance of these pellets is shown in the accompanying figure (fig. 1):

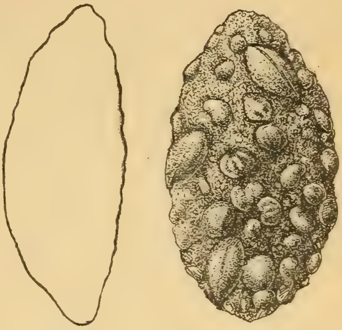

FIG. 1.—Crow pellet or casting.

The number of seeds distributed by Crows is enormous, and since it has been shown by experiment that the vitality of such seeds is not impaired by the partial digestion to which they are subjected, it is evident that Crows effect the distribution of many plants.

Reference to the chapter on the vegetable food of the Crow (pp. 81–87) will show that the stomach contains fruit seeds at all seasons, but especially during the autumn. It is certain, therefore, that southward-bound Crows deposit the seeds of many common fruits all along their migration route. Some of these, as the wild cherry (*Prunus*), flowering dogwood (*Cornus*), and red cedar (*Juniperus*), produce valuable and beautiful trees or shrubs, while others, like the poison ivy and poison sumac (*Rhus*), are detestable weeds. In the vicinity of roosts such seeds are sown by the million; many of these survive and add to the store of food for birds, and some to the misery of mankind.

The following facts serve to show how extensive is this seed planting by Crows in the vicinity of the winter roosts: On February 8, 1889, I visited the well-known—almost historical—Crow roost located on the Virginia side of the Potomac River just opposite Washington, D. C. The exact location of this roost varies from time to time, but at the date mentioned it was entirely within the grounds of the national cemetery at Arlington, and covered an area of 12 or 15 acres of second-growth deciduous trees. The ground beneath these trees was pretty evenly covered with the ejecta of the Crows, forming a deposit which in places was an inch or more thick, though the average deposit was probably rather less than half an inch. A representative spot free from underbrush was selected, and all the material above the leaves from an area 2 feet square was carefully collected, dried, and examined. The weight of this material when dry was almost exactly 1 pound, and it contained (aside from gravel, bits of bone, shell, corn hulls, and some excrement) the following seeds:

	Number.
Poison ivy (*Rhus toxicodendron*)	1,041
Poison sumac (*Rhus venenata*)	341
Other sumacs (*Rhus*)	3,271
Juniper or red cedar (*Juniperus virginiana*)	95
Flowering dogwood (*Cornus florida*)	10
Sour gum (*Nyssa aquatica*)	6
Total	4,764

A little calculation shows that the roost of 15 acres must have contained upward of 778,000,000 seeds, or more than enough to plant 1,150 acres as thickly as wheat is sown.

Of course the seeds thus dropped at the roost are subject to such unfavorable conditions that comparatively few grow, but it must be remembered that Crows spend only the hours of darkness at the roost, while during at least twelve hours each day they are dispersed far and wide over the surrounding country, collecting and distributing these seeds. The process of digestion—at least the preliminary process—is very rapid in Crows. A caged Crow experimented on during several months in the winter of 1889-90 ate berries of poison ivy with greater relish than any other wild fruit obtainable. He swallowed about 80 berries within a few moments, taking several mouthfuls of sand immediately afterwards, and about thirty minutes later he disgorged a large pellet consisting entirely of sand and the seeds of the *Rhus* berries, the latter with every shred of pulp removed by the action of the gizzard-like stomach. Subsequent experiments showed that indigestible substances, such as the teeth and bones of mice, hard seeds, snail shells, and so on, were not always disgorged with such promptness. In one case a white-footed mouse (*Peromyscus leucopus*) was fed to this Crow in the forenoon, and later in the day—but before any pellet had been disgorged—a common house mouse (*Mus musculus*) was given him. In little more than an hour afterwards a pellet was disgorged consisting mainly of the fur and bones of the common mouse—the last swallowed—and it was not

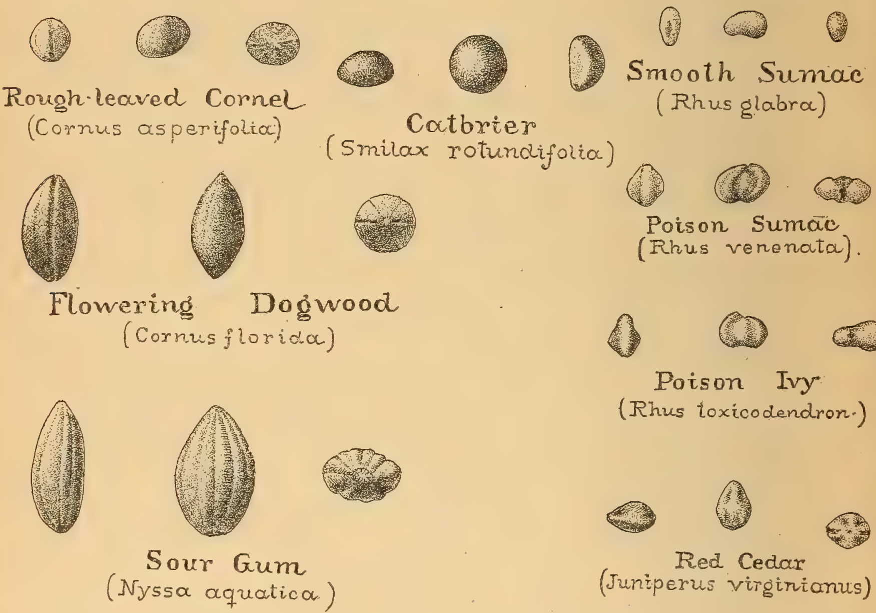
Rough-leaved Cornel
(Cornus asperifolia)
Catbrier
(Smilax rotundifolia)
Smooth Sumac
(Rhus glabra)
Poison Sumac
(Rhus venenata).
Flowering Dogwood
(Cornus florida)
Poison Ivy
(Rhus toxicodendron.)
Sour Gum
(Nyssa aquatica)
Red Cedar
(Juniperus virginianus)

FIG. 2.—Some common seeds found in Crow pellets.

until nearly twenty-four hours later that the teeth of the white-footed mouse were ejected. Experiments made with various other articles of diet containing hard parts showed conclusively that although the indigesta were commonly disgorged in from one to four hours after eating, some pieces were often retained for twenty-four hours or even longer, and from the presence in Crow stomachs of bits of much worn bone, or of seeds worn smooth by constant attrition, it seems certain that such things are sometimes kept for even longer periods. It should be stated further that on several occasions well-grown mice were fed to the same Crow, and the pellets subsequently disgorged showed no trace of bones, but consisted solely of hair, teeth, and the inevitable sand. There is no reason to doubt that the bones were ground up in the stomach and completely digested.

The amount of sand or gravel taken by an average Crow during cold weather is almost beyond belief. When fresh sand was put into the cage of the Crow he would put his head down close to the sand, turn his bill sideways and half open, and swallow, time after time, all that his bill would hold. In this way he frequently took the equivalent of three or four teaspoonfuls of clear sand in less than a minute, washing it down immediately with copious drafts of water. After witnessing this a few times, and finding that it was repeated at intervals all through the day, usually soon after eating, the thick deposit of sand and gravel which always occurs at Crow roosts was easily accounted for.

CHAPTER II.

ANIMAL FOOD OF THE CROW.[1]

With a few minor exceptions the entire economic relations of the Crow depend upon its food habits. What the Crow eats or does not eat determines, directly or indirectly, the nature and extent of his services or damages to the agriculturist. The sources of information on this subject are various, and each is open to some objection which can not be entirely eliminated.

METHODS OF INVESTIGATION.

By carefully watching Crows, either with the naked eye or with a field glass, facts may be observed which are of more or less value. Thus, in cold weather, when Crows are seen to visit the carcass of a dead animal, the inference is fairly safe that they are eating the flesh. During hot weather, however, numerous flies, maggots, and scavenger beetles in and about the carcass might be the attraction instead of the carrion.

Frequently a Crow may be seen robbing the nest of some useful bird or despoiling a cherry tree or strawberry bed of its fruit, and in such cases the common inference is that these are examples of regular habits of the bird, and that much of his living is gained in this way. Such an inference, however, is not justified by the facts, and only a long series of similar observations would render it even probable. Again, a Crow may be seen walking quietly about in a meadow or pasture, frequently picking up something. Nothing of the nature of this food can be discerned—even with the best field glass, and the observer is left to speculate whether it be insect, seed, sprout, bulb, fruit, or perhaps a mixture of all. No one habit is so universally known as that of pulling up Indian corn. Almost every farmer has seen it done, and often the rows have been examined within a few moments after the crows have left, yet there are still some observers who contend that the corn is pulled for the sake of the grub or worm hidden near its root, and that the seed corn itself is seldom or never eaten. It is difficult to prove that the missing seed corn has been broken off and left in the ground when the sprout was pulled, and still more difficult to show that any grub or worm has been taken from the ground.

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[1] The insects eaten by the Crow are discussed in chapter III, pp. 56–71.

By careful experiment with living Crows—either caged or tame—many interesting points may be determined, though the natural appetite and food of a bird can not always be determined from the study of partially domesticated individuals. There remains but one method of study which promises anything like uniformly good results, namely, the examination of the actual contents of the stomachs of Crows.

For many years the division has been collecting Crow stomachs from every part of the country and at all seasons of the year. This collection numbers more than 900, most of which were taken in summer. As the examination of these stomachs has been supplemented by a large quantity of material from the winter roosts, it is believed that the data at hand are ample for the settlement of all the important questions relating to the food of Crows. In collecting these stomachs the utmost care has been taken to preserve all data that might throw light on the habits of the bird or in any way assist in the identification of the contents of the stomach. In most cases the following facts have been recorded: (1) Sex and age; (2) date of capture; (3) hour of capture; (4) town, or at least county, where killed; (5) character of actual place where killed; (6) name of collector; (7) remarks as to place of killing, occupation of bird when killed, character of crops in vicinity, and abundance of any particular food.

METHOD OF EXAMINING STOMACHS.

Since the determination of the various ingredients of the stomach contents is not always a simple matter, a description of the method pursued may be of interest. A few stomachs are obtained fresh, but the great majority received in the laboratory are preserved in alcohol. The process of examination, however, is essentially the same in both cases. A stomach is cut open and by means of a jet of water the contents are washed into a dish; then more water is added. Any conspicuous insects or large pieces of food that float are picked out and allowed to drain on blotting paper. The water covering the remainder is poured upon a filter and replaced by fresh water, which in turn is decanted upon the filter, and the process continued until the water remains clear and most of the lighter material has been removed. The coarser material is now spread out thinly under water and examined with a hand lens. By tilting the dish from side to side most of the sand or gravel can be separated and this is collected on a blotter by itself. The remaining coarse or heavy material is thoroughly examined with a magnifier. The seeds and grain are picked out and placed by themselves, also the bits of bone, shell, and the hard parts of insects. Sometimes this results in the separation of a dozen or more little heaps, each composed of one kind of material, and these heaps are arranged in three groups, composed respectively of animal, vegetable, and mineral matter. The mineral matter is examined for bits of shell, teeth of fish, reptiles, or mammals, and small, heavy bones, which often give a clew to the character of some of the soft food. The utmost care is needed to distinguish fragments of the hard parts of insects, particularly jaws, and the heads of weevils, and also small seeds that are likely to be overlooked among the bits of sand and gravel. The finely broken bits of insect shell usually float. Advantage is taken of this fact by throwing water into the vessel in a strong jet so that it may entangle bubbles of air and rise to the top, where they can be skimmed off.

The fine matter collected in the filter is examined under the hand lens, or the compound microscope if necessary, and by comparison with the coarser material it is possible frequently to determine not simply that it is vegetable or animal dust, but to name the particular animal or plant from which it came. In any case, the animal, vegetable, and mineral components of this fine material are separated and added to the coarser material already isolated.

After the materials contained in the stomach are recognized the next step is to determine the percentages of animal, vegetable, and mineral matter. For this purpose the smallest heap or mass of identified matter is selected as the unit, and each of the other heaps is divided into portions of like size. Then, by a very simple process, it is possible to determine the proportion of each ingredient of the food, and it has been found most convenient to express this proportion in percentages. For instance, if the heap of sand and gravel is selected as the unit, the animal matter may be 2½ times as much and the vegetable matter 3½ times, giving a total of 7 parts, each of which represents 14.3 per cent. In this case, therefore, the record would stand: Animal matter, 35.7 percent; vegetable, 50 percent; mineral, 14.3 percent. The proportions by weight would be very different from those by bulk, and these again would differ from those based on the numbers of individual seeds or insects found in the stomach.

In the case of a bird which eats insects only it might be possible to use the numerical method with some accuracy; yet even then much would have to be left to individual judgment in estimating how many small insects were equivalent to one large one, or how many harmful insects would be necessary to offset the consumption of a given number of beneficial insects. Moreover, only under the most favorable circumstances would it be possible to determine just how many individuals of each kind were represented in the stomach contents, for, even if swallowed whole, so soon as digestion begins the individual insects become dismembered, crushed, and broken, and within a short time only the hardest parts, such as the heads, wing covers, legs, and jaws, remain in recognizable condition.

It has seemed best, therefore, in attempting to determine the proportions of the various food substances in Crow stomachs, to depend upon the method of equal masses or bulks, which method is adopted in the present bulletin. In most cases the number of individual seeds, insects, or other animals has been recorded also, but these numbers have not been considered in determining percentages.

RELATIVE PERCENTAGES OF ANIMAL AND VEGETABLE FOOD.

The average quantities of animal, vegetable, and mineral matter contained in the entire number of stomachs could be easily computed; but such averages would be of little value in view of the wide differences in the numbers of stomachs examined in different months. Evidently the averages for the year must be obtained on a different basis, allowance being made for the discrepancies in the number of stomachs examined. The nearest approach to such a basis is found in the monthly averages given in the following table:

Table showing average percentages of the animal, vegetable, and mineral contents of 909 Crow stomachs, arranged by months.

Month.	Number examined.	Animal.	Vegetable.	Mineral.
January	53	21.5	60.9	17.6
February	23	10	71	19
March	26	19.2	67	13.8
April	42	62.1	31.2	6.7
May	364	66.6	29.5	3.9
June	165	49.5	46.3	4.2
July	45	37.3	55.6	7.1
August	24	37	56.9	6.1
September	44	27.1	66	6.9
October	46	18.8	67.4	13.8
November	18	33.2	55.5	11.3
December	59	12.1	74.3	13.6

By averaging these results it is possible to reach a conclusion which is correct so far as the monthly averages themselves are trustworthy. In cases where 40 or more stomachs have been averaged for any one month the result may be taken as approximately correct, and when, as in May and June, the number exceeds 100, it is probable that the examination of twice as many would not alter the averages materially. November is the month about which most doubt exists, although the numbers for February and March are also too small. The results in the case of the last-mentioned months, however, are strengthened by the examination of material from the crow roosts, while the results for August are partially confirmed by the fact that they are, as theoretically they should be, intermediate between those of July and September.

On this basis the annual averages of stomach contents are as follows: Animal matter, 32.9 percent; vegetable matter, 56.8 percent, and mineral matter, 10.3 percent. Roughly speaking, it may be said that one-third of the food annually consumed by Crows consists of animal matter, about three-fifths of vegetable matter, and about one-tenth of mineral matter. Of course the latter component is not food, strictly speaking, and its elimination would change the proportions of food proper to: Animal food, 36.6 percent; vegetable food, 63.4 percent

However, as a certain amount of sand or gravel is essential in grinding grain and other vegetable matter, it seems desirable to take it into consideration, at least while dealing with the general proportions of the elements of the food.

The accompanying table shows the number of stomachs examined for each month and the number containing each of the more prominent articles on which the Crow is known to feed:

Table showing contents of Crow stomachs, by months.

[The figures indicate the number of stomachs containing the article named.]

Month.	Number of stomachs examined.	Carrion.	Rabbits.	Mice.	Poultry or wild birds.	Egg shells.	Reptiles and batrachians.	Fish.	Crawfish.	Mollusks.	Insects and spiders.	Corn.
January	53	26	1	......	......	7	3	2	4	6	21	31
February	23	6	......	1	......	1	1	1	......	2	10	16
March	26	6	......	3	......	3	2	3	3	1	16	12
April	42	2	3	11	2	......	15	8	9	1	36	17
May	364	57	31	45	60	......	175	15	83	23	358	214
June	165	22	3	5	23	......	45	4	15	9	157	68
July	45	4	......	4	5	......	8	3	4	3	42	14
August	24	4	......	2	......	......	2	1	1	1	24	6
September	44	3	......	......	4	......	4	1	4	4	40	22
October	46	4	......	4	......	......	3	2	5	9	42	21
November	18	3	......	1	1	......	2	3	2	6	17	10
December	59	9	1	2	......	......	3	3	9	10	30	48

Month.	Wheat.	Oats.	Buckwheat.	Mast.	Seeds (grass, weeds, etc.).	Harmless *Rhus*.	Poison *Rhus*.	Other berries.	Apples.	Grapes (wild and cultivated).	Strawberries, blackberries, and raspberries.	Cultivated cherries.	Wild cherries.
January	3	5	......	8	13	20	10	3	1	......	......	......	......
February	1	2	......	5	3	8	1	2	......	......	......	......	......
March	1	4	2	8	8	2	......	......	1	......	......	......	......
April	2	4	2	2	6	3	......	3	1	......	......	......	......
May	6	6	3	24	11	1	......	2	......	......	2	3	......
June	3	13	6	6	6	3	1	12	......	......	16	37	......
July	10	3	......	3	4	......	......	6	1	......	12	13	......
August	4	3	......	......	1	......	2	6	2	3	2	......	5
September	4	3	1	7	2	......	8	13	1	12	1	......	6
October	5	1	1	20	4	......	16	9	......	15	......	......	2
November	1	1	......	7	1	2	7	3	1	2	......	......	......
December	3	2	......	9	9	13	14	4	......	2	......	......	......

The assumption that Crows will eat any available animal food may be allowed to stand as substantially correct, with some important reservations as regards insects, and it remains simply to discover what kinds of animal food are most available, and what preferences are shown when choice is possible. The following table shows the different kinds of animal food commonly found in Crows' stomachs and the relative quantities of each:

Table showing percentages of the different kinds of animal food found in Crows' stomachs, arranged by months.

Month.	Number of stomachs examined.	Rabbits.	Mice.	Mammals not identified.	Offal or carrion.	Wild birds and their eggs.	Poultry and their eggs.	Tortoises.	Snakes.	Frogs and toads.	Fish.	Crustacea (mainly crawfish).	Mollusca (mainly snails).	Insects and spiders.	Total animal food.
January...	53	.5	......	......	17.5	trace.	.2	......	.3	trace.	.1	.2	.3	2.2	21.5
February .	23	......	.2	......	6	......	trace.	......	......	.4	.1	......	trace.	3.3	10
March	26	......	3.5	.2	1.2	......	1.1	......	......	.2	1.5	5.7	trace.	5.8	19.2
April	42	2	2.5	.1	.4	1.2	......	.5	trace.	3.6	1.7	.9	trace.	49.2	62
May	364	3	2.8	trace.	1.6	.8	1.1	1	2.3	3.4	.3	1.6	.1	47.9	67
June	165	.5	.7	.1	1.1	2.4	.5	.4	trace.	1.4	.1	.2	.2	40.0	49
July	45	......	2.7	......	.2	2.2	.2	......	......	4.2	.3	.6	.2	26.5	37.3
August ...	24	......	.4	......	.5	......	......	......	trace.	.2	.1	trace.	trace.	35.6	37
September	44	......	......	.1	1.6	......	.2	......	......	.3	trace.	.1	.2	24.6	27.1
October ...	46	......	.1	......	.1	......	......	......	1	trace.	trace.	.7	.1	16.7	18.8
November.	18	......	.2	......	3.2	......	.8	......	1.7	.2	.5	.2	.7	25.8	33.2
December.	59	.2	.1	.8	2.7	......	......	trace.	......	.3	.4	1.2	1.5	4.7	12.1
Average for year..	909	.5	1.1	.1	3	.6	.4	.2	.4	1.2	.4	.9	.3	23.5	32.9

For reasons already explained the annual average for each item of food in this table is obtained by averaging the monthly averages. Probably the most striking feature is the great importance of insects and spiders, which not only exceed any other single kind of food in all months except January and February, but the average for the year is more than double the combined averages of all other items. The next largest element is offal or carrion, and then follow successively frogs and toads, mice, crustacea, wild birds and eggs, rabbits, snakes, fish, poultry and their eggs, and various other materials.

Before proceeding to take up these separately it should be stated that the item offal or carrion as given in the table is incomplete, since it includes only such as could not be covered by any of the other headings. Almost every item doubtless includes some carrion, since it was often impossible to tell whether the animals found in a stomach had been killed by the Crow or were dead when picked up.

RELATION OF THE CROW TO MAMMALS.

RABBITS.

Remains of rabbits are common in Crow stomachs, particularly the common cottontail (*Lepus sylvaticus*) which must count the Crow one of its deadly enemies. It is not probable that adult rabbits are often attacked, but after the young begin to run about they are frequently pounced upon and carried away. On one occasion the writer saw a tragedy of this kind while driving along a Maryland road in June. A Crow suddenly sailed over the fence and alighted in the road about

100 yards ahead of the horse. As he lit, he struck savagely with his bill at some dark object on the ground which tried to escape by jumping from side to side, but the Crow followed each motion, striking quickly and heavily each time until the animal lay quiet, when, after a thorough pounding, the bird prepared to tear his quarry to pieces. Alarmed by the near approach of the wagon, he seized his prey in his bill and flew heavily over the bushes which fringed the road. Creeping to the fence I was able to identify the victim as a young rabbit, and subsequently found its tracks in the road at the point where the Crow had attacked it. My companion said that usually he had seen young rabbits at this place in the road for a week past, but this was the first time he had seen one attacked by a Crow.

Remains of rabbits occurred in 38 of the stomachs examined, and were most numerous in May, when they formed 3 percent of the entire food, 30 stomachs taken during this month containing an average of 37 per cent of rabbits (flesh, bones, hair, and teeth). These were almost invariably young, usually less than half grown. Of course it is possible that some were dead, but by far the greater number must have been caught and killed. In stomachs taken in April and June remains of young rabbits occurred to a less extent, but at no other season were any found.

A single stomach from Maryland, taken in December, contained remnants of an adult rabbit, and similar remains were found in a stomach from Argentine, Kans., collected in January. Mr. G. E. Stilwell, the collector of the last-named stomach, gives the following account of the capture of the rabbit by five Crows. He says:

"On January 2, 1891, I was at a small station called Zarah, after rabbits and birds, and was crossing some rough, stony hills where the snow was 3 or 4 inches deep. When on top of one of the hills my attention was drawn to some Crows making a great fuss about something, and so I crawled through the weeds and brush until I was in shelter of a stone fence and about 30 feet from the birds. I had a splendid view of the fight, which lasted about half an hour. The Crows took regular positions, one as a sentinel on a low tree over the others, one on the stone under which their victim was hiding, and the other three would walk as if about to go under the stone. The rabbit would try to come out, only to be driven back by savage pecks from the bird on the stone. When he was finally dead they began to peck his head as if eating. I did not wait any longer, but secured the sentinel and one other."

Another correspondent, in Livingston County, Mo., mentions the fact that Crows kill rabbits, but the habit seems to have escaped general notice, in spite of the fact that, as shown by the preceding table, rabbits enter more largely into the Crow's diet than poultry and eggs, of which he is supposed to be particularly fond.

MICE.

Except when the ground is covered with snow, mice form one of the more important articles of the Crow's food, ranking fourth in the list of items of animal food. The average for the year almost equals that of frogs and toads, and, with this exception, is exceeded only by insects and by offal or carrion. The average for the year is little more than 1 percent (1.108 percent), but in March the amount reaches 3½ percent; in April and May it exceeds 2½ percent, and though in June it falls considerably below 1 percent (0.7 percent), it rises again to $2\frac{7}{10}$ per cent in July. But these averages, taken by themselves, would be rather misleading, since they give little indication of the actual number of mice killed or devoured. The highest average in the table occurs in March; yet in that month only 3 stomachs out of 26, or less than 1 in 8, contained remains of mice, while in April 11 stomachs out of 42, or more than 1 in 4, showed such remains, although the average quantity in the latter month was only about two-thirds that in March. In May 47 Crows out of 364, or about 1 in 8, had eaten mice, while in July, with approximately the same average amount, only 4 out of 45, or 1 in 11, contained their remains.

A considerable number of the mice found in Crow stomachs should be considered as carrion. In many cases the odor was sufficient to indicate this fact; in other cases additional certainty was given by the presence of carrion beetles or burying beetles (*Silphidæ*) of several species. In many instances, however, these indications were useless, from the fact that the remains of several different animals were present in the same stomach, and it was impossible to connect the odor or the carrion beetles more closely with one than another.

It is probable that at least half the fragments of mice found in stomachs could be safely called carrion, but there is abundant proof from several sources that Crows often capture living mice, particularly the short-tailed meadow mice, which build their nests usually on the surface of the ground, among the roots of grass. Here the Crows discover them, and tearing the nest to pieces devour the young, and not infrequently catch the adults as well. By far the greater number of the mice found in the stomachs were meadow mice or voles (genus *Microtus*), and most of them were the commonest species (*Microtus pennsylvanicus*).

During the long winters of the Northern States, when snow covers the earth continuously to a depth of several feet, these meadow mice live in nests of dry grass on the surface of the ground, beneath the snow. Dr. C. Hart Merriam states that in northern New York the warmth of the nest and its contents causes the snow to melt around, and especially above, the nest, forming a dome-shaped chamber in the snow, which gradually increases in size until toward spring the snow roof falls in or melts away, leaving a hole through which the grass nest at the bottom may be seen. The Crows have learned to watch for these holes, and by descending suddenly and tearing the nest to pieces they often succeed in capturing the inmates.

That this habit is not confined to the Adirondack region is shown by a letter from Allan C. Brooks, of Chilliwack, British Columbia, in which he says: "In Ontario I have seen Crows working the fields for field-mice nests when the snow was about 6 inches deep and the nests were conspicuous by the round orifice through the snow caused by the warmth of the nest melting the snow above it."

Among the reports of other correspondents are eighteen or twenty which mention the fact that Crows eat mice. Since these give no additional details, it is unnecessary to do more than refer to them.

Not in early spring alone does the Crow hunt for the nests of field mice; he is always on the lookout for them, especially during the late spring and summer, when they are more likely to contain young. The Crow's habit of searching for food on the ground, and particularly of poking his bill into bunches of dead vegetation and under the roots of grasses and weeds in pastures and meadows, favors the discovery of these nests. Others are exposed by the mower, and constitute one of the many attractions that draw Crows to the hay field. Crow stomachs taken in July contain about four times as many mice as those taken in June. In meadow lands the mice and their nests are well hidden in June by the luxuriance of the grass, while in July they are exposed when the grass is cut. Besides the meadow mouse or vole (*Microtus*), remains of the common house mouse (*Mus musculus*) were found in many stomachs, and in several cases bones, teeth, and fur of the white-footed mouse (*Peromyscus*) occurred. In one instance four young Crows from a brood of five had been fed on a jumping mouse (*Zapus hudsonius*).

In thickly settled districts most of the other natural enemies of mice—hawks, owls, foxes, skunks, and weasels—exist only in small numbers, if at all, and the increase and spread of the house cat only supplies their places in part, and that at the sacrifice of vast numbers of small birds, to which the cat is extremely partial. The capture of each living mouse by the Crow is therefore an act of positive benefit to the agriculturist, and must be given due weight in trying to ascertain the Crow's economic status.

Crows in captivity evince the greatest relish for mice; in fact it is doubtful if any other article of food is so attractive. Even newly caged Crows, which refused to eat other food of any kind while watched, laid aside all fear when a mouse was shown them, and would crowd up to the bars and even take the mouse from my fingers, pecking savagely at each other in their eagerness to secure sole possession of the coveted tidbit. This experiment was repeated many times and with different Crows. It seemed impossible to gorge a Crow to such an extent that he would refuse a mouse. When a single mouse was given to several Crows the fortunate one that secured it was compelled to swallow it whole in order to prevent the others from seizing it, but he invariably disgorged it later and pulled it to pieces. Subsequently the hair, teeth, and some of the bones were disgorged as a pellet precisely as with hawks and owls, although in some cases most of the bones were ground up and entirely digested. It seems probable that this is rendered possible by the large amount of sand or gravel habitually swallowed after every meal, and the great muscular power of the stomach, which is practically a gizzard.

GROUND SQUIRRELS AND GOPHERS.

A few fragments of bones identified as those of a ground squirrel, presumably the eastern chipmunk (*Tamias striatus*) were found in one stomach. In this case it was impossible to tell with certainty whether or not the remains were carrion. The habits of the chipmunk make it improbable that the Crow often captures one alive, and then only in case the animal is very young. In the Mississippi Valley, where the striped ground squirrel (*Spermophilus tridecemlineatus*) is abundant, the Crow may capture the young occasionally, but the fact that these animals nest in burrows prevents the Crows from feeding on the young until they are able to run about.

Mr. William J. Howerton, of Florence, Pinal County, Ariz., states that he has seen the Crow of that region catching and killing the common pocket gopher (*Thomomys*). It is probable that this observation relates to the white-necked raven (*Corvus cryptoleucus*), as that is the commonest Crow of the region, although the true Crow (*Corvus americanus*) occurs there during migration. In any case, however, the Crow can not be regarded as an important enemy of this animal, since pocket gophers rarely appear above ground and it is not to be supposed that Crows are able to unearth them from their burrows.

One or two correspondents state that Crows destroy the young of arboreal squirrels, and this undoubtedly is true, although it can not be a very common practice.

BATS, MOLES, AND SHREWS.

Bones, teeth, and other vestiges of bats, moles, and shrews were found in twelve stomachs, all in May and June. But since the quantity of these remains for the year is less than one-tenth of 1 percent, they are of little economic import. It is possible that some of the shrews (remains of four individuals were found) may have been killed by the Crows, but it is much more likely that they were found dead, as must have been the case with the moles (*Scalops aquaticus*), two specimens of which were represented. Bats' bones or teeth occurred in six stomachs, but four of these stomachs belonged to nestlings of a single brood, and the remains were those of only a single bat.

UNIDENTIFIED MAMMALS.

Twelve Crow stomachs contained small quantities of fragments of small mammals which it was impossible to identify. These aggregated for the year only about one-twentieth of 1 percent (0.055 percent), at least half of which should be classed as carrion, so that the total is insignificant.

ATTACKS ON SHEEP AND SWINE.

It is well known that birds of prey are on the alert to discover sickly, wounded, or disabled animals. The Crow possesses this trait to a considerable degree, and although it does not often attack large animals until they are in a dying condition, there is reason to believe that it does so sometimes. Several correspondents state that it is guilty of these practices. Nevertheless, our efforts to secure authentic details of such cases have been unsuccessful except in a single instance. Mr. George A. Coleman, of London, Nebr., says that he was an eyewitness to a Crow's attack on a large live hog during a severe storm in the winter of 1881–82, when the corn was covered with snow and the Crows could not get at it. He did not see the first attack on the animal, but when he first saw the Crow on the hog's back it was tearing at a hole already 2 or 3 inches deep. The hog, a fat, heavy animal, was making strong but unsuccessful efforts to rid himself of his assailant. Hogs belonging to other farmers in the vicinity were reported to suffer in a similar manner, all, however, during the same winter and at about the same time.

A fair example of the newspaper reports on this subject is the following, recently clipped from the Kansas Live Stock Record:

"The ravenous Crows have destroyed two fine litters of pigs for me, picking them to death; and on Mr. A. J. Alexander's farm in Kentucky they have been feeding on his pigs, biting off their tails, ears, and even picking their eyes out."

In 1886 Mr. John S. Caulkins, of Thornville, Mich., wrote the Department as follows: "A grave accusation is made against Crows by some old farmers, who say they have known them to peck out the eyes of young lambs. I am inclined to think that in any such cases it would be found on investigation that the lamb was dead or dying before it was attacked by the Crows."

Prof. F. S. Place, of Alfred Center, N. Y., also wrote about the same time that Crows in his vicinity had been known to pick out the eyes of very young lambs.

RELATION OF THE CROW TO OTHER BIRDS.

Two serious charges are made against the Crow as regards its relation to other birds, namely, that it destroys the eggs and young of domesticated fowls, and is even more destructive to those of wild birds.

The evidence at hand sustains both. The testimony of observers is abundant and unimpeachable, yet it must be confessed that it gives an exaggerated idea of the extent of the evil. On the other hand, the examination of large numbers of stomachs, revealing comparatively few instances of these bad habits, tends perhaps to an underestimate of the evil. A comparison of the two sets of information and study of the combined data should give fairly trustworthy conclusions. The subject will be considered under two heads: (1) The destruction of eggs and young of poultry; (2) the destruction of eggs and young of wild birds.

DESTRUCTION OF EGGS AND YOUNG OF POULTRY.

This habit of the Crow has been well known for a century at least. The early settlers of eastern North America were much troubled by Crows, and took measures to lessen their numbers. Wilson, writing in the first decade of the present century, speaks of the Crow as "detected in robbing the hens' nests, pulling up the corn, and killing the young chickens," for which "he is considered as an outlaw and sentenced to destruction." Audubon, who was very favorably disposed toward the Crow and believed him to be a valuable friend ot the agriculturist, omits all mention of his attacks on chickens or young poultry, but speaks with evident admiration of his skill in carrying off eggs.

Many good observers have described the Crow's methods in catching young poultry, but perhaps no better account has been written than that published more than sixty years ago by Dr. John D. Godman.[1] After years of careful observation, mainly in Anne Arundel County, Md., Dr. Godman says:

"Where food is at any time scarce, or the opportunity for such marauding inviting, there is scarcely a young animal about the farm-yards safe from the attacks of the Crow. Young chickens, ducks, goslings, and even little pigs, when quite young and feeble, are carried off by them. They are not less eager to discover the nests of domestic fowls, and will sit very quietly in sight, at a convenient distance, until the hen leaves the nest, and then fly down and suck her eggs at leisure. But none of their tricks excited in me a greater interest than the observation of their attempts to rob a hen of her chicks. The Crow, alighting a little distance from the hen, would advance in an apparently careless way toward the brood, when the vigilant parent would bristle up her feathers and rush at the black rogue to drive him off. After several such approaches, the hen would become very angry and would chase the Crow to a greater distance from the brood. This is the very object the robber has in view, for as long as the parent keeps near her young the Crow has very slight chance of success; but as soon as he can induce her to follow him to a little distance from the brood, he takes advantage of his wings, and before she can regain her place, has flown over her and seized one of her chickens. When the cock is present, there is still less danger from such an attack, for chanticleer shows all his vigilance and gallantry in protecting his tender offspring, though it frequently happens that the number of hens with broods renders it impossible for him to extend his care to all. When the Crow tries to carry off a gosling from the mother, it requires more daring and skill, and is far less frequently successful than in the former instance. If the gander be in company, which he almost uniformly is, the Crow has his labor in vain. Notwithstanding the advantages of flight and superior cunning, the honest vigilance and determined bravery of the former are too much for him. His attempts to approach, however cautiously conducted, are promptly met, and all his tricks rendered unavailing, by the fierce movements of the gander, whose powerful blows the Crow seems to be well aware might effectually disable him. The first time I witnessed such a scene, I was at the side of a creek and saw on the opposite shore a goose with her goslings beset by a Crow. From the apparent alarm of the mother and brood it seemed to me they must be in great danger, and I called to the owner of the place, who happened to be in sight, to inform him of their situation. Instead of going to their relief, he shouted back to me, to ask if the gander was not there too, and as soon as he was answered in the affirmative he bid me be under no uneasiness, as the Crow would find its match. Nothing could exceed the cool impudence and pertinacity of the Crow, who perfectly regardless of my shouting, continued to worry the poor gander for an hour, by his efforts to obtain a nice gosling for his next meal. At length, convinced of the fruitlessness of his efforts, he flew off to seek some more easily procurable food. Several Crows sometimes unite to plunder the goose of her young, and are then generally successful, because they are able to distract the attention of the parents and lure them farther from their young."

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[1] Rambles of a Naturalist, 1833, pp. 65–66.

Similar quotations might be made from the writings of other observers, some assuming that the habit is common, or even universal, among crows, others that it is exceptional or confined to a few individuals. It seems probable that the latter view comes nearest the truth, since in many parts of the country the habit does not appear to have been noticed. We have corresponded with several hundred observers, representing almost every State and Territory in the United States, but in many cases no charges of chicken stealing have been brought against the Crow. The habit of egg stealing seems to be much more general, yet in numerous instances the reports are entirely from hearsay evidence. Unquestionably the Crow is very adroit in his attacks on young poultry, and it is probable that many of his thefts are unknown to the farmer, or are only suspected after frequent repetition. A single instance of such robbery will persist in a man's mind, and two or three are sufficient to convince the average farmer that the habit is universal.

More than 200 correspondents state that they have either seen or heard of damage to poultry and eggs by Crows, and about one-sixth of this number are positive that such damage is frequent and serious. On the other hand, more than 150 observers state that they have no personal knowledge of any such damage. Under such circumstances, especially if the reports are from localities where Crows are known to breed abundantly, it is impossible to avoid the conclusion that Crows rarely carry off young poultry; but in other localities it is equally certain that the habit is common.

The following statements from observers have been selected from more than 100 similar notes:

From John A. Weems, Flora, Bullock County, Ala.: The Common Crow is the worst egg thief I ever had to contend with. I never knew it to catch young chickens, but it destroyed at least 100 turkey eggs for me during last spring and early summer. 1886.

From C. L. Rawson, Norwich, Conn.: The Crow is a common enemy to the domestic turkey when breeding, frequently eating eggs and sometimes young. It ate 14 turkey eggs for a Preston farmer on June 1. I once saw a Crow flying with a duck egg in its bill, or rather with its bill thrust into the egg. 1886.

From Frank B. Hancock, Casky, Christian County, Ky.: Crows undoubtedly catch young chickens and steal eggs, and they have caused me more trouble in that respect than hawks. My home is situated on the south side of a woodland in which a colony of Crows located in 1870. This spring (1885) I have watched them carefully, and have seen them steal chickens before they were past the downy stage, and carry them away to their young. I have one Crow family charged with $25 worth of chicks stolen in April and May last.

From Dr. D. W. Prentiss, Washington, D. C.: Crows were observed to destroy young chickens frequently on farms at Moreland, near Adamstown, Md. This was well known to the farmers, and means were taken to protect the chicks. 1886.

From Prof. F. E. L. Beal, Lunenburg, Mass.: I have seen it catch at least one young chicken, and in several cases have had no doubt of its guilt. 1886.

From H. Nehrling, Freistatt, Lawrence County, Mo.: I have frequently observed them stealing the eggs from my poultry yard. They do this very slyly and quietly. As soon as the eggs are hatched they carry off the young chickens whenever they can get them. With the exception of Cooper's hawk, I do not know such a bold robber as the Crow. One day in April one of these birds perched on the fence, only a few steps from my house. An old hen with about a dozen chickens which were only a few days old was in my barnyard. Suddenly the Crow swooped down, caught a chicken with its bill, and went off, flying away near the ground. In a few weeks the Crows carried off about 20 chickens which varied in age from one day to four weeks. 1885.

From Dr. A. K. Fisher, Sing Sing, Westchester County, N. Y.: I have known Crows to carry off as many as 20 chickens from a single farm during a season. I have repeatedly observed them fly silently and perch on a tree near where the chickens lived, but in every case they were either killed or frightened away before any of the chickens were molested. 1885.

From F. L. Burns, Berwyn, Pa.: I have seen the Common Crow catch young chickens early in the spring when other food was scarce. It also steals chicken and turkey eggs, particularly when they have nests in a field near the woods. 1886.

From T. Scott Fisher, East Brook, Lawrence County, Pa.: If other food is scarce, the Crow will catch and eat young chickens until they are the size of a quail; it also eats eggs. I have seen it do both at least six different times. 1887.

From Witmer Stone, Germantown, Pa.: I have heard from reliable authority of Crows carrying off young chickens, but have never seen them do so myself. I frequently have seen them sucking the contents of turkey eggs, but only when the turkeys had laid in some retired place, not near the barnyard. 1886.

From Edwin B. Clark, Waxahachie, Ellis County, Tex.: I have known it to take young chickens and steal eggs in early spring, about March and April, particularly when the weather was very dry. I have never known it to do this except during the breeding season. The laying season here begins early in February and lasts until May. 1886.

Evidence furnished by stomach examination.—Traces of poultry or their eggs were found in 46 of the 909 stomachs examined. Twenty-one other stomachs contained bird remains which could not be positively identified as belonging to domesticated fowls, though in many cases this was probable. Allowing half these doubtful remains to have been those of poultry, we have a total of 57 stomachs, 6¼ percent of all examined, or about 1 stomach in 16. Of this number, however, 17 were taken in the months of January, February, March, September, and November, and the bird remains contained in these may be safely recorded as carrion or offal. The remaining cases occurred in May, June, and July, and presumably in most cases they can not be placed under the head of carrion or offal.

Table showing remains of poultry or eggs found in 616 Crow stomachs collected from April to July.

Stomachs examined.	April.	May.	June.	July.	Total.
Number of stomachs examined	42	364	165	45	616
Number containing poultry		11		1	12
Number containing eggs of poultry		15	2	2	19
Number containing unidentified birds		3	1		4
Number containing unidentified eggs		4	3		7
		33	6	3	42
Deduct stomachs counted twice					2
Total					40

This table shows that during the nesting season of the Crow, the time when the greatest damage to fowls and their eggs might be expected, only about 1 Crow in 15 had eaten either. Even this statement is too high, since 19 of the stomachs that contained remains of poultry belonged to young Crows taken from 6 nests.

Turning now to a consideration of the actual quantity of such food taken, it appears that the eggs and young of poultry form only a very small part of the Crow's food even during the nesting season. As already stated, such food was found in 40 stomachs taken during the breeding season and 19 of these were nestlings from 6 nests. The average quantity in each stomach was a little less than 12 percent (11.9). The average for all the stomachs taken during the breeding season, 616 in all, is only a little more than three-fourths of 1 percent (0.77), and the average for the year (909 stomachs) is a little over half of 1 percent (0.52).

DESTRUCTION OF EGGS AND YOUNG OF WILD BIRDS.

The older American naturalists speak of the Crow as one of the well-known enemies of the smaller wild birds. Audubon, after describing the Crow's attacks on the poultry yard, simply remarks: "It is as fond of the eggs of other birds as is the cuckoo."[1] Wilson[2] says: "In spring, when he makes his appearance among the groves and low thickets, all the feathered songsters are instantly alarmed, well knowing the depredations and murders he commits on their nests, eggs, and young."

Nuttall supposed the Crows of America, Europe, Asia, and even Australia to belong to one and the same species, and his remarks about their destroying eggs and young birds appear to have been based on a knowledge of the habits of the English Carrion Crow (*Corvus corone*), which is said to be particularly fond of the eggs and young of the European partridge. Dr. Brewer,[3] as late as 1874, wrote as follows: "They also occasionally commit depredations in the barnyard, robbing hens' nests of their eggs, and even destroying young chickens. They also destroy the eggs and young of other birds."

In 1867 Mr. E. A. Samuels, then State Ornithologist of Massachusetts, published, in his 'Birds of New England,' a somewhat lengthy discussion of the Crow's economic status, in which he threw out of the account every charge against the bird save that of the destruction of the eggs and young of wild birds, and yet concluded that the damage done in that way alone outweighed the good done in all ways combined at least 20 to 1. In making this estimate, which probably represents the extreme of exaggeration on this side of the question, Samuels states that he has seen a pair of Crows, in two visits to an orchard, within a half hour destroy the young birds in two robins' nests. This doubtless is perfectly true, for such occurrences are not very rare; but that does not justify the further statement that "it is perfectly reasonable to say that it destroys [each day in May] at least the eggs or young of one pair of sparrows, four in number; one pair of warblers, four in number, and one pair of thrushes or starlings, four in number."[4] It may be reasonably doubted whether any pair of Crows in America ever averaged anything like the above slaughter, even for a single week, while Mr. Samuels considers this only an average day's work for May, and allows double the amount for the whole of June and the first half of July.

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[1] Ornithological Biography, II, 1835, 319. Audubon, in common with a majority of writers on birds, credited the stories that cuckoos eat the eggs of other birds. The charge is a time-honored one, but from all the evidence now available, it seems to be groundless.—W. B. B.

[2] American Ornithology, Edinburgh ed., Vol. I, 1831, p. 245.

[3] Hist. North Am. Birds, II, 1874, p. 245.

[4] See also Rept. Comm. Agriculture for 1867, p. 207 and Samuels' Our Northern and Eastern Birds, 1883, p. 360.

In regard to the birds attacked, it is undoubtedly true that the smaller kinds suffer most.

In the American Naturalist for April, 1874, Caroline Boyce speaks of the Crow in eastern New York as follows: "The Crow commits fearful and cruel depredations on the robin and his belongings. The species is a bitter foe to all smaller birds, and keeps them in severe check."

Robert T. Morris wrote to Forest and Stream, in July, 1876: "By the time the young Crows are hatched [in New England and New York] the smaller birds are nesting, and it is at this season that the Crow is most destructive. The eggs and young of the smaller birds are appropriated by it on every opportunity for at least two months in the year. * * * I have known a pair of Crows to destroy the young in three robins' nests in one day."

In the August number (1876) of the same journal Oliver D. Shock, of Hamburg, Pa., wrote: "In the spring, when other birds are building their nests * * * the insectivorous tribe suffer most severely from these black marauders, as no sooner does the Crow find a nest than it pounces on the innocent occupants, and be they eggs or birds they will be devoured. * * * I have frequently seen them near my residence, on the banks of the Schuylkill River, pounce down upon an innocent robin sitting upon her nest, make her abandon it, and then gobble up the nestful of embryo songsters."

These visits are not always seen, as the Crow approaches the nest either by stealth or by sudden assault during the absence of the parent birds, well knowing that by so doing he avoids the attacks of the nest owners and their friends and sympathizers. The smaller sparrows, finches, and warblers are unable to make much resistance, but the Crow prefers larger eggs and young, and the attacks of robins and blackbirds, especially when several pairs combine, are not to be despised. The following account by Montague Chamberlain, of St. John, New Brunswick, illustrates a form of strategy to which the wily Crow sometimes resorts: "I was attracted to a bunch of trees by a commotion among a troop of robins, and discovered some six individuals fiercely attacking a Crow, a second black form being detected skulking some little distance away. Presently Crow No. 1 flew off, followed by the entire mob of excited redbreasts, when Crow No. 2 made a dash into the trees, and emerged with an unfledged robin grasped in his dexter claws, the youngster kicking and piping lustily. The cries brought back the guardians, who at once gave chase to the captor, and while they were off in one direction Crow No. 1 charged the nest from an opposite point, and retired with another of the brood firmly held in his claws." (The Auk, I, 1884, p. 92.)

Accounts of similar attacks on small birds have been received from correspondents with considerable frequency. One of the recent reports came from F. R. Welsh, of Philadelphia, Pa., in a letter dated May 29, 1893. It is as follows: "Yesterday afternoon I was attracted by the cries of a young robin and some old robins and blackbirds. Running toward an evergreen from which the cries came, I saw a Crow fly out with a young robin in its bill. Three old robins chased it a short distance, and the blackbirds for about 300 yards, when the Crow lit on a fence, but did not drop its victim. In the evergreen I found a robin's nest containing one young robin apparently dead, but still warm. There was a drop of blood on a branch below the nest, but I could find no marks of injury on the young bird in the nest. * * * When the nest and vicinity were examined again two hours later no sign of the young bird could be found. Probably the Crow took it also."

The frequency with which the robin is mentioned in the reports of correspondents indicates that it is peculiarly subject to the attacks of the Crow, in spite of the fact that robins nest most commonly in the orchards and shade trees near houses. In attacking such nests the Crow is likely to come early in the morning, evidently because it has learned that at such a time he is least likely to suffer from human interference. The same fact has been observed in regard to the attacks on chickens and on corn planted near houses.

It is well known that several kinds of wild birds prefer the neighborhood of houses when nesting, and as a rule such species increase rapidly with the settlement of a region. This has been attributed in part to the increase of food supply and in part to the immunity secured from natural enemies, of which the Crow is one.

Crow blackbirds unite to attack a Crow, but the enemy often escapes without injury. Robins, too, combine to punish the despoiler of their homes, but they seldom follow the thief far, and probably their bills are too weak to be very serviceable in such skirmishes.

It seems probable that originally the robin, like most other birds, secured the safety of its nest by hiding it from its enemies. Mr. Martin Trippe says: "The breeding habits of birds undergo considerable modification on the settlement of the country. In the wilds of Minnesota I never saw the nest of the robin elsewhere than in the tops of the tallest Norway pines. The Crow in similar localities often builds on low bushes."

It is true that even now the robin frequently hides its nest successfully in the thickest part of some evergreen tree, but in many, perhaps most, cases no such concealment is attempted. This neglect of concealment is sufficient to account for a large proportion of the cases in which the cat-bird, mocking bird, brown thrasher, and crow blackbird are the victims. From the concentration of these birds in the orchards, shade trees, and shrubbery about houses, the robbery of their nests is more often witnessed, and doubtless this fact leads to an overestimate of the harm done by the Crow to small birds in general.

After the young of the smaller birds are out of the nest, and before they are able to care for themselves, the Crow doubtless picks them up whenever possible. Mr. Charles A. Davis, of Burlington, Vt., wrote in 1885 that he had seen Crows catch and carry to their nests 8 or 10 young bank swallows which were feathered out. In the summer of 1889 the writer saw a Crow start from the top of a high tree in pursuit of a meadow lark (probably young) which was crossing the field below. The Crow almost reached its intended victim before the latter was aware that it was followed, but by a vigorous use of its wings, and much sharp dodging and twisting, it finally escaped, though the chase lasted several minutes.

Dr. W. S. Strode, of Bernadotte, Fulton County, Ill., wrote to the Department as follows: "On April 20, 1888, a farmer from the prairie south of town reported to me that the Crows were killing prairie hens on his farm, chasing them till worn out and then killing and eating them."

It is well known that the nests of game birds are occasionally plundered by Crows, but except under unusual circumstances the harm is not serious. As a rule it may be assumed that our native game birds are able to hide their nests so as to escape the keen eyes of the Crow. Those which lay light-colored eggs, as the bobwhite, probably run most risk, but the parent birds are protectively colored, and the eggs are seldom left uncovered for any length of time. The nests of waterfowl are subject to the attacks of Crows, which hang about the breeding places, always ready to take advantage of any emergency which may expose the eggs or young. In some cases waterfowl evidently depend upon their own presence in numbers to prevent loss, and many species carefully cover their eggs with leaves, moss, or other substances, when they leave them, so that they are not readily discovered.

In the case of most birds nesting in colonies, however, some loss is likely to occur, and occasionally the persecution by Crows may be sufficient to break up the colony, as in the following instance related by Mr. A. G. Van Aken:[1] "About ten pairs of night herons (*Nyctiardea grisea*) and three pairs of little blue herons (*Ardea cœrulea*) have nested for a few years within the corporate limits of the city of New Brunswick, N. J. When I visited this heronry late in April, 1882, I discovered that one nest already contained four eggs, two others each three, several more one and two, while the remainder were as yet empty. About two weeks later, after climbing up to a number of nests, and passing from the top of one tree to another, where this was practicable, thus examining nearly all, I was surprised to find each empty, though the old birds fluttered overhead or alighted near by. At the base of many of the trees in which nests were situated lay the eggs with pieces broken out and the meat gone. I suspected two parties of the robbing, either the red squirrel (*Sciurus hudsonius*) that I saw some distance away, or else a number of Crows that were perched in a neighboring tree cawing lustily. On May 20 I examined the nests a third time, finding them again without eggs, while fresh shells were strewn on the ground.

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[1] Ornithologist and Oologist, Vol. VIII, 1883, pp. 46–47.

"The herons were now shy and restless, whereas the Crows, for whom I entertained a strong aversion, were more audacious and clamorous than ever. A subsequent and final visit revealed conditions unchanged, the Crows as officious as ever, so that it being very late in the season, I was satisfied that no young birds were reared last year."

Accounts of similar depredations on heronries are by no means rare, but although the eggs and young herons doubtless constitute the primary attraction at such breeding places, it is probable that the Crows get the fish and other food accidentally dropped by the herons while feeding their young, as herons are notoriously careless in this respect. The following account[1] by Mr. J. Foster, of the plundering of Florida rookeries by Crows illustrates forcibly the intelligence of these dusky thieves, and their readiness to take advantage of circumstances:

"In the years of 1874 and 1875 a party of us made two round trips to Lake Okeechobee, Florida, by way of the Kissimmee River. We also took a third hunt as far as Fort Kissimmee. In these voyages it was very interesting to observe the habits of the Crow. All the herons and water turkeys (darters or snakebirds) had built in the hummock adjoining the water. Whenever our boat, the *Forest and Stream*, suddenly rounded a point there was a great stir in the rookeries and a lively time for the Crows. The latter birds seemed to know our movements, for they were ever on the alert at every disturbance, and began actively to plunder the nests, robbing them of both eggs and young birds. When we came to a rookery of plume birds our guns created great confusion among the herons; but the Crows seemed to take in the situation, and apparently understood our intention, for they paid no attention to the noise of our guns, but plied their work of destruction upon the eggs and young as mercilessly as did we upon the old birds. As long as we continued shooting they made havoc among the nests."

Herons, ducks, and most other waterfowl are not quick enough on the wing to drive the Crows away and thus secure safety for their nests. Sometimes, however, Crows attempt to impose upon species which are able to defend themselves.

Mr. B. H. Dutcher gives the following account[2] of the persecution of four Crows by terns on a small island at the eastern end of Long Island Sound in August, 1888: "Four unlucky Crows sometime in the spring, before the terns arrived, decided to take up their residence on Great Gull Island. * * * It might have been that they came in search of food, for the island was well stocked with the eggs and young of the terns. If so, they were sadly disappointed, for no sooner had the terns arrived than they fell on the crows and persecuted them relentlessly, until we put an end to their misery. Leave the island they could not, for did one attempt to rise a horde of terns was at him almost before he had risen above the grass, and screaming, diving, and dashing at the unfortunate bird would soon drive him back to the earth again, and then, as if not content with that, would continue to worry him long after he had settled down. The Crows were in a sorry plight, indeed, for the terns, not satisfied with worrying their victims at a distance, even went so far as to peck out the poor birds' feathers; and between the exuviæ that the terns had dropped on them, and the light patches where the feathers had been picked out, the Crows presented a rather mottled appearance. From the upper mandible of one Crow a piece of the sheath and bone, half an inch long and an eighth deep, had been gouged out, undoubtedly by the lower mandible of a tern. This incessant persecution had rendered the Crows so tame that we could always approach to within 25 feet of them before they would fly, and Charles B. Field told me that on one occasion he caught one in his hand, the bird preferring rather to be caught by the man than to be chased by the terns."

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[1] Forest and Stream, VII, 1876, p. 84.

[2] The Auk, VI, 1889, pp. 129–130.

Summary of evidence furnished by stomach examination.—Of the 909 Crow stomachs examined only 41 contained eggs, feathers, bones, or other remains which could be identified certainly as those of wild birds. Twenty other stomachs contained remains which may or may not have belonged to wild birds. Half of these have been added to the wild birds, while the remainder have been referred to poultry. A single stomach taken in January contained two vertebræ of a small bird, doubtless found dead by the Crow; but with this exception all the remains of wild birds were in stomachs taken in April, May, June, and July. During these months 616 stomachs were collected. The following table shows the number which contained remains of wild birds or their eggs in each month:

Table showing number of Crow stomachs containing remains of wild birds or their eggs.

Month.	Number of stomachs examined.	Number of stomachs containing—				Total.
		Wild birds.	Eggs of wild birds.	Unidentified bird remains.	Unidentified eggs.	
April	42	2				2
May	364	16	5	3	4	28
June	165	9	7		3	19
July	45	2				2
Total	616	29	12	3	7	51
Deduct stomach counted twice						1
						50

The above table indicates much less injury to wild birds and their eggs than has been supposed. It appears that the injury is confined to young birds and eggs, and consequently occurs only during the breeding season, or from April to July. It is shown further that during this time, on an average, only 1 Crow in 12 eats any young birds or eggs, and even this proportion is much too high, as will be clear from a consideration of the fact that 38 of the stomachs containing remains of birds or eggs were those of Crow nestlings, and 25 of these were from 9 nests, containing 2 to 5 young each. Since in most cases a single bird is torn in pieces and divided among all the young in a nest, it is evident that the number of birds destroyed has been greatly overrated. Furthermore, of the 12 stomachs remaining, several belonged to the parents of the above nestlings, so that the number of Crows actually concerned in destroying the young and eggs found in these 50 stomachs could hardly have been more than half of 50, and it seems probable that not more than 1 Crow in 20 ever becomes addicted to this sort of stealing.

It should not be inferred that birds and eggs are specially sought for as food for nestling Crows. The fact that many more young Crows than old ones were collected during the summer months, and that a single bird is usually divided among the young of a nest, accounts for the larger number of young stomachs containing such food. As a rule, when feathers, eggshells, or other bird remains occurred in the stomach of one nestling in a brood they occurred in all, and in most such cases the remains in the several stomachs were all referable to a single victim, showing that the parents must have divided the food pretty evenly among the young. In several cases two or three members of a family had received food of a totally different character from that furnished the rest, and occasionally one or two stomachs were well filled while the others from the same nest were but partly filled or almost empty, but this was very unusual. Young and rapidly growing Crows need a larger proportion of animal food than adults, and in case such food is scarce it is possible the parents give a larger share to the young, contenting themselves with food more easily obtainable. It is noticeable that of the stomachs containing eggs a large majority were from adult Crows, while the remains of fledgelings occurred most frequently in the young. The probable explanation is that old Crows find it difficult to carry eggs without breaking, especially as they are so often attacked and worried by the birds robbed.

In the case of eggshells the estimated percentage undoubtedly is too small, for the shell commonly formed only 1 or 2 percent of the stomach contents and the soft parts of the egg had disappeared completely.

The actual quantity of bird remains found in the stomachs is comparatively small. In very few cases did it form as much as half of the entire stomach contents, though in one or two stomachs it exceeded that proportion. The average for the 50 stomachs was about $18\frac{1}{3}$ per cent, or only $1\frac{1}{2}$ percent for the 616 stomachs taken during the season. The average annual amount in the 909 stomachs was almost exactly 1 percent.

In regard to the kinds of birds found in the stomachs, it was possible to determine but little. Nestlings, especially when very small, are not easily identified under favorable conditions, while it is almost impossible to name them after they have been plucked, dismembered, and partly digested. Occasionally a piece of a skull, the tip of a bill, or a more or less complete foot would justify a guess at the family or genus to which the victim belonged, and in a single case a few characteristic feathers, together with the early date (April 22, at Washington, D. C.), made possible the identification of the species—a young meadow lark. One stomach contained, among other remains, the stomach lining of a small bird, and doubtless the food originally contained in the small stomach had mingled with that properly belonging to the Crow. Another stomach contained nearly the whole of a small bird, including the entire stomach, which still inclosed considerable food, mainly parts of insects and their eggs. In neither case was it possible to identify the bird to which the stomach belonged.

The eggshells found in Crow stomachs could not be identified absolutely in any case, but they yielded .some interesting indications. In two cases the shells were those of either the robin or the wood thrush, and in another case probably belonged to the cat-bird. In five other stomachs the shell fragments were thin and distinctly blue but in such small bits that it was impossible to determine whether they were spotted or not. It is probable, however, that most of these eggs belonged to robins, cat-birds, or thrushes.

RELATION OF THE CROW TO REPTILES, FISHES, AND INVERTEBRATES.

DESTRUCTION OF REPTILES.

Tortoises.—The examination of Crow stomachs brought to light the somewhat unexpected fact that Crows destroy considerable numbers of young tortoises—or terrapins as they are generally called in Maryland and Virginia. This item of food is noticeable during April, May, and June. Only young tortoises are eaten, those of very small size predominating, though occasionally larger ones are taken. From lack of material for comparison it was not practicable to identify all the species represented, but fragments of the snapping tortoise (*Chelydra serpentina*) were most abundant, although the painted tortoise (*Chrysemys picta*) and the box tortoise (*Cistudo carolina*) also occurred frequently. In many cases every trace of tortoise flesh and bones, and even the shell, had disappeared from the stomach, leaving only the horny tips of the jaws, which appeared to resist both the grinding action of the stomach and the dissolving action of the digestive fluids. Many, perhaps most, of the tortoise remains were in the stomachs of nestlings, and in one instance an old Crow, shot as she was approaching her nest, dropped a small tortoise.

Since this kind of food was taken only during one-fourth of the year the annual average is very small—only about one-sixth of 1 percent of the food—but in May it formed almost 1 percent, occurring in 33 stomachs out of 364, or in about 1 stomach out of every 11. The average in the 33 stomachs was 10.5 per cent. In April the remains were found in about one-eighth of the stomachs, but the average quantity was smaller in May, and still less in June. One stomach taken in December contained 2 percent of tortoise remains, evidently carrion.

The following statement from Mr. John M. Richardson, of Daingerfield, Tex., is of interest in this connection, as it was published at a time when the extent of the Crow's depredations on these reptiles was entirely unsuspected by us (Annual Report Dept. Agriculture for 1888, p. 524). Mr. Richardson, who seems to be the only correspondent who has noticed this habit, says:

"The Crow is known to catch young terrapins, and there is reason to believe that it destroys other small reptiles. I remember a rock-crowned hill on the east bank of the Wateree, between Manchester and Statesburg, in Sumter County, Ga., that was almost covered with remains of small terrapins and land tortoises carried there and devoured by Crows."

Snakes and lizards.—Crows eat many snakes, some of which they kill. Mr. B. T. Galloway, chief of the division of vegetable pathology of the Department of Agriculture, details a battle between a Crow and a large snake (at least 3 feet long) which was witnessed near his house at Garrett Park, Md., during the summer of 1893. The Crow not only struck the snake repeatedly with his bill, but lifted it from the ground and beat it with its wings, the snake meanwhile writhing, twisting, and attempting to bite its antagonist. The fight lasted half an hour or more, and eventually the snake was killed and partly eaten. A singular feature of this combat was the fact that one Crow did all the fighting, although several others watched the struggle from a neighboring fence. The following account of a similar battle appeared in the Ornithologist and Oologist[1] for February, 1883, and seems to have been written by the editor, Joseph M. Wade: "While riding down through Occum, Conn., on May 26 last (1882) we noticed a Crow on a level garden bed killing a snake which was not less than 18 inches long. The snake seemed fully conscious of what was going on and tried to get away, but showed fight every time it was seized. It was interesting to see the Crow bite him, lift him up, and throw him to the ground, keeping one eye on us the while. This went on for some time, the snake getting weaker every bout. The Crow evidently not liking the nearness of myself and carriage, seized the snake within a few inches of its head and flew with it into the large trees beyond the Wequonock River where we could not watch its further operations. The snake hung down its full length while being carried over the river."

Reports from correspondents in Ontario, Massachusetts, Connecticut, New York, Maryland, Virginia, Kentucky, Kansas, and Texas show that in all those localities the Crow preys regularly on snakes either dead or alive, and there is no reason to doubt that its habits are the same in this respect everywhere throughout its range. The stomachs which contain remains of snakes represent most of the States already mentioned, also Georgia, Florida, and Wisconsin. Probably half the ophidian remnants in these stomachs were carrion, but the exact proportion is not determinable. The annual average is about half of 1 per cent (0.45 percent), but the average for May reaches 2¼ percent, and during this month at least 1 stomach in every 6 contained remains of snakes, the average for the 62 stomachs exceeding 13 percent. It is not probable, however, that the remnants in these stomachs represented as many as 62 snakes, for in many cases a single snake sufficed for an entire brood of young, and it rarely happened that parts of a snake were found in one stomach of a brood and not in the others.

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[1] Vol. VIII, No. 2, Feb., 1883, p. 11.

It can hardly be claimed that in killing snakes Crows do any good, and it may be fairly questioned whether some real harm is not done. If the snakes were poisonous the case would be different, but so far as observed all the victims were harmless species, most of which feed largely on insects, mice, frogs, and similar food, the consumption of which is advantageous, or at least not detrimental to the agriculturist. On the other hand, the black snake and some other kinds destroy insectivorous birds and eggs. But it is probable that most of the snakes eaten by crows are carrion, killed by man, not by Crows.

Crows eat a few lizards, but under ordinary circumstances they are too active to be caught easily, and their protective coloration is an additional safeguard. In the Northern United States lizards occur sparingly or not at all, but from Maryland southward they are fairly abundant; still, among several hundred Crow stomachs from the Southern States traces of lizards were found in only one. A single stomach, taken at Sandy Spring, Md., in May, contained the bones of a small lizard (probably *Sceloporus undulatus*).

Frogs and toads.—No animal food occurs more regularly in Crow stomachs than remnants of frogs and toads. Toads are notoriously clumsy and unfortunate, and it may be presumed that many, if not most, of those found in the stomachs of Crows had been stepped on or otherwise injured, and subsequently appropriated by the sable scavengers. Frogs, on the other hand, rarely suffer from accidents of this kind, and probably most of those eaten by Crows are captured alive. The great abundance of frogs in most places accounts in some measure for the frequency with which they are captured.

It has been supposed that the peculiar acrid secretion of the skin of the toad is a protection against natural enemies; and it has been observed that few dogs can be induced to bite a toad, and after one attempt they usually refuse to renew the attack, showing unmistakably by their actions and by the free flow of saliva that the toad's secretion is very unpleasant, if not actually painful. Whether or not this secretion is distasteful to Crows is unknown, but it is certain that Crows consume large numbers of toads and frogs. In many cases the warty skin of the toad has been found in the Crow's stomach, showing conclusively that it is not discarded when the rest of the victim is swallowed.

Remains of frogs or toads were found with greater or less frequency in stomachs collected during every month in the year, the aggregate being 151 stomachs out of a total of 909 and the average proportion of the food for the year 1.2 percent. The greater number of these batrachians were eaten in April, May, June, and July, the average for these months being: April, 3.6 percent; May, 3.4 percent; June, 1.4 percent; July, 4.2 percent. During these four months frogs and toads formed 3.2 percent of the food of the Crow, a larger amount than any other single item of animal food except insects. In April this food was found in 9 stomachs out of 42, or about 1 in 5; in May it occurred in 99 out of 364, or about 1 in 3½; in June the number was 27 out of 165, or about 1 in 6, and in July, 6 out of 45, or nearly 1 in 7. During the remainder of the year the amounts were insignificant.

Most of the remains belonged to the common toad (*Bufo*) and various species of frogs (*Rana*), but several stomachs contained bones of tree frogs (*Hyla*).

As to the good or harm resulting from the Crow's consumption of frogs and toads, several points should be considered. Toads are mainly insectivorous, and consume immense numbers of insects, often of the most injurious kinds. Therefore, whenever the Crow kills a toad it is inflicting direct loss on the agriculturist. Frogs, likewise, are purely carnivorous, and consume large numbers of insects; but from their restriction in the main to marshy ground and the immediate vicinity of water the insects they are able to catch are of much less economic importance than those eaten by toads. On the other hand, the Crow certainly kills more frogs than toads, and as little harm, but some good, is done by frogs, the balance, on the whole, is unfavorable to the Crow.

Newts, efts, or salamanders.—These harmless little animals, so often confounded with lizards, form one of the minor items of the Crow's food. They occur all over the United States, except in the arid regions, and in favorable locations some of the smaller species are met with in large numbers. All live in wet, or at least damp, situations, and some pass their entire lives under water.

The Crow's habit of turning over small stones, chips, and the like favors the discovery of these little amphibians. The largest species found in the stomachs (*Desmognathus fusca*) did not exceed 4 inches in length, and most of those discovered were scarcely half as large. Consequently, even if eaten in considerable numbers, they do not form any large part of the food, since the average for the year amounts to less than one-tenth of 1 percent. In May 34 stomachs out of 364, or 1 in

11, contained their remains, and in June the proportion was about 1 in 12. In some cases the remains of as many as a dozen salamanders were found in a single stomach, but usually fragments of but one or two occurred, and the ratio seldom exceeded 10 percent, the average for 52 stomachs being less than half this amount—4.8 percent.

The habits of these salamanders are but imperfectly known, but they are supposed to feed mainly on animal substances, in part insects. Their economic importance is insignificant.

DESTRUCTION OF FISH.

Parts of fish of various kinds were taken from 46 of the 909 Crow stomachs examined, and the average amount in these 46 stomachs was about 6 percent. The average percent of fish in the year's food was less than half of 1 percent, and in only two months, March and April, did it exceed 1 percent. Most of the fragments found were unquestionably parts of dead fish, and therefore, so far as present purposes are concerned, might be merged with carrion or offal, although sufficient evidence is at hand to show that at least some Crows are able to catch fish for themselves. The first record of this habit, so far as we are aware, was published by Dr. Edgar A. Mearns in 1880.[1] The note relates to Highland Falls, N. Y., and is as follows: "Crows are expert fishers. In winter they watch at the fissures in the ice alongshore at low tide, and claw out whatever fishes are passing. I have known two Crows to capture upward of 20 good-sized goldfish (*Crassius auratus*) in less than an hour's time."

The following observation by Mr. L. I. Flower, of Clifton, New Brunswick, was published[2] by Montague Chamberlain in 1884. "A few years since, while crossing the Washadermock Lake, I noticed a Crow flying close to the surface at a spot where the water is very shoal. Suddenly, when but a short distance from my boat, the Crow thrust his claw down into the water and drew to the surface what I afterwards discovered was a fish of about half a pound weight, and then seizing it with his bill, by aid of 'tooth and nail' succeeded in drawing it out of the water and carrying it to an adjacent rock, the fish all the while struggling hard to get free.

DESTRUCTION OF CRUSTACEANS.

Crustaceans are prominent in the food of Crows at all seasons, standing fifth on the list showing relative percentages of the animal food of the year. The annual average amounts to nearly 1 percent (0.95 per cent). Out of the 909 stomachs examined, 137 contained remains of *Crustacea*, and in all but 14 cases these were crawfish. In January the only remains were those of 'sow bugs,' or 'pill bugs' (*Oniscus*), which occurred in four stomachs. These are terrestial crustaceans abundant in damp places, and were found in stomachs of Crows shot near garbage heaps in the vicinity of Washington. In March, October, and December, the remains consisted mainly of marine crabs, doubtless thrown up by the sea, and captured dead or alive by the Crows along the seashore. One stomach taken in December contained barnacles amounting to 40 percent of the contents. This food, except the crawfish, has no economic significance, and the greater part may be safely counted as carrion or offal. Crawfish, on the other hand, are capable of doing considerable damage, particularly by tunneling dams or embankments, and by throwing up mud 'chimneys' on low grass lands. It is by no means certain what proportion of the remains found in stomachs should be regarded as carrion, but since fragments of crawfish occurred in 123 stomachs it is extremely probable that the Crows have learned where and how to catch these crustaceans alive. In the month of May 83 stomachs, or almost 1 in every 4, contained their remains, the average for these exceeding 7 percent, while the average of all the stomachs, that is, the percentage of the entire food for the month, was a little more than 1½ percent (1.6 percent). No other month shows so large a record of crawfish, although in April they were found in 9 stomachs out of 42, and the average for the 9 was over 4 percent.

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[1] Bull. Essex Inst., Vol. XII, 1880, p. 109.

[2] The Auk, Vol. I, 1884, p. 391.

Of course Crows on the seashore get large numbers of crustaceans, both alive and thrown up dead by the waves, but in general the consumption of this food has little bearing on the economic status of the Crow.

DESTRUCTION OF MOLLUSKS.

The presence of mollusks in the stomachs of crows was determined in most cases by fragments of their shells, and the utmost care was necessary to determine in each case whether these bits of shell were parts of entire animals taken as food or simply part of the gravel so generally swallowed to aid digestion. As a rule the latter was assumed to be true whenever the fragments had worn edges, otherwise the former. Sometimes entire snails were found, and occasionally large fragments of fresh or salt water bivalves, but in the majority of stomachs no such decisive matter was present.

Among the Crows taken at a distance from the sea the traces of mollusks were confined to land snails (mainly *Helix*) except in one or two cases where fragments of shells of fresh-water mussels (*Unio*) occurred. Crows have been credited pretty generally with the habit of lifting clams, mussels, and other shellfish high in the air and dropping them on hard objects in order to break the shells and get at the contents. An observation on this subject illustrating the acuteness and intelligence of the Northwest Fish Crow (*Corvus caurinus*) was published by H. W. Henshaw in the Youth's Companion, January 9, 1890. Mr. Henshaw says:

"Some years ago, while wandering along the shores of Puget Sound, in what was then Washington Territory, I noticed a flock of Fish Crows flying out to a small island which the ebbing tide was just revealing. Each one in turn seized some object in his bill, and flying to the rocky shore dropped it on the rocks, and then descended to feast upon it.

"Investigation showed that the objects were mussels. Instead of hammering the shells open, which would have cost time and labor, the Crows, in order to get at the contents, resorted to the easy and expeditious mode of letting the mussels fall on the rocks.

"No doubt the trick was learned by accident, as many an important invention of man has been. A flying Crow accidentally dropped a mussel on the rocks, and noting the result repeated the experiment to his own and his observing relatives' profit; and so in time, through inheritance, the habit became fixed among Crows.

"At the same place I observed a herd of hogs rooting in the beach at the water's edge, and as I paused to note what they were about, presently along came several Crows. To my amazement they flew, one to each pig, and perched on the head between the ears.

"From this lookout each Crow kept a bright watch on the hog's snout, evidently on the qui vive for whatever should turn up, and not for a moment was his attention diverted.

"Presently one of the hogs rooted up a razor clam, when immediately down pounced the alert, but unprincipled Crow, seized the prize, and made off to devour his ill-gotten booty at leisure. The stupid, but honest and hard-working porker renewed his labors, apparently with no sense of his loss, and at all events with no visible signs of resentment against the robber; but as long as I played the part of spectator no razor clam fell to the lot of the pigs."

The amount of sea food in the stomachs examined was comparatively small, and the annual average of the single item, mollusks, was little more than one-fourth of 1 percent. Even the relatively large amount in December (about 1½ percent) is due to the presence of an unusual quantity (55 percent) in a single stomach, the average in 8 other stomachs amounting to only 3 percent.

Beside the crustaceans and mollusks, remains of a few other invertebrates were found, but only two or three need be mentioned. Myriapods—all millipeds—occurred in perhaps a dozen stomachs, but always in very small numbers, the amount exceeding 1 percent in only a single instance. A small leech was found in 1 stomach, and earthworms in 9. One of these stomachs contained 63 percent of earthworms, and another 33 percent, which, with the additional fact that no vertebrate remains appeared in either case, makes it reasonably certain that the worms were eaten intentionally. Three other stomachs, from young Crows of one family, contained, respectively, 2, 7, and 25 percent of earthworms. The remaining 4 stomachs, all from one nest, contained about 1 per cent each of setæ of earthworms, but as these were associated with the remains of a shrew, a snake, a frog, and a newt, all of which animals (with the possible exception of the snake) are known to eat earthworms with avidity, it seems probable that the earthworm bristles may have been derived from the stomach of one of the included animals. It is a noteworthy fact that Crows in following the plow have been seen to leave the earthworms untouched, although greedily eating white grubs and other larvæ exposed in the furrow. Moreover, according to my experience, Crows in confinement usually refuse earthworms, and never show any great relish for them. Young Crows repeatedly rejected earthworms when put in their mouths, and unless pushed far down their throats they absolutely refused to swallow them.

As illustrating the fondness of the Crow for food hidden within hard outer coverings or shells, and the further fact that a given item may form a large part of a Crow's food in one part of the country and not in another, the following note by J. Walter Fewkes[1] is of interest:

"Near Eastport, Me., there is known to be a considerable deposit of the broken tests and half decomposed soft parts of our common New England sea urchins (*S. drœbachiensis*) far removed above the level of high water.

"This deposit is formed in the main of fragments of the solid tests of these echinoderms, which are said to have been carried there alive by Crows, which frequent the locality in great numbers."

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[1] The Auk, Vol. I, 1884, p. 92.

CHAPTER III.

INSECT FOOD OF THE CROW.

The matter of the Crow's utility as an insect destroyer is one of prime importance; in fact, it is the crucial test of the bird's value The material available for the decision of this question consists of the insect contents of 909 stomachs, taken at various places and times, the great majority during the warmer half of the year.

Most of the older ornithologists recognized the fact that Crows ate insects in considerable numbers, but ignored the fact that many insects are beneficial; and moreover they took no pains to determine what proportion of the Crow's diet consists of insects. Even at the present time these points are very generally overlooked, and to the best of our knowledge there is nowhere a record of the carefully identified contents of a dozen Crow stomachs taken in summer. A few naturalists have put on record the results of more or less thorough examinations, but in too many cases we find only such general statements as 'contents consisted of seeds, berries, and insects,' or possibly of 'grain, carrion, and beetles,' without any attempt to determine the kind or amount of each.

Eight hundred and one out of 909 stomachs examined contained insect remains in quantities varying from the merest trace to 100 per cent. The following table shows the number of Crow stomachs collected during each month, the numbers which contained insect remains, and the average percentage of such remains for the whole number of stomachs in each month:

Table showing average percentages of insect material contained in 909 Crow stomachs, arranged by months.

Month.	Number examined.	Number containing insects.	Percentage of insect contents.
January	53	21	2.2
February	23	10	3.3
March	26	16	5.8
April	42	36	49.2
May	364	357	47.1
June	165	157	40
July	45	42	26.5
August	24	24	35.6
September	44	40	24.6
October	46	42	16.7
November	18	17	25.8
December	59	39	4.7
Total	909	801	23.5

It appears from this table that the average quantity of insect material in these 909 stomachs was almost 24 percent. A moment's examination of the table shows, however, that the number of stomachs examined in different months is very unequal, and also that the percentage varies widely according to season. The average percentage represents the proportion of insects to the whole stomach contents, but from 7 to 10 percent of the stomach contents is sand or gravel. Throwing out this mineral element, it appears that on the average 26.17 percent of the Crow's food for the year is made up of insects. In the same way it is found that even in January, when the smallest proportion is eaten, insects form almost 3 percent (2.71) of the food, while the maximum is reached in April with almost 53 percent (52.75). In May, insects constitute about 49 percent (48.97) of the food, and in June about 41½ percent.

During the months of May and June 529 stomachs were collected; insects formed 46.7 percent of all food in these stomachs. Since these two months cover the larger part of the time when Crows are rearing young, this large proportion of insect food perhaps is not surprising, especially as 396 stomachs were those of young Crows taken from the nest. The insect food in the stomachs of these nestlings averaged 49.6 per cent, while the average amount in the stomachs of 120 adult Crows taken during May and June was only 36.4 percent. This shows conclusively that young Crows while in the nest eat more insects than the adults, the difference in this case amounting to more than 13 percent of the entire food; or, to put the matter in another form, nestling Crows eat at least one-third more insects than the adults. It is of great importance, however, that the character of this insect food be carefully determined, so that we may know positively whether its consumption is or is not of benefit to the agriculturist. Fortunately, this has been done. After the preliminary examination of the contents of each stomach and the determination of the percentages of the several kinds of food contained the insect material was referred to Prof. C. V. Riley, then chief of the division of entomology, under whose direction it was thoroughly studied by Mr. E. A. Schwarz. The following reports contain the results of this examination:

REPORT ON THE INSECT FOOD OF THE CROW.

By E. A. SCHWARZ, *Assistant, Division of Entomology.*

The examination of the contents of about 600 stomachs of Crows[1] submitted by Dr. C. Hart Merriam to the division of entomology was intrusted to me by Dr. C. V. Riley, then United States Entomologist. Owing to the large bulk represented by the majority of the stomach contents, and more especially to the comminuted condition of the insect remains, the work of examining and determining was much more tedious and progressed much slower than was anticipated. In the often times difficult determination of minute fragments I have been greatly assisted by the other members of the division of entomology, and more especially by Messrs. William H. Ashmead and Theo. Pergande.

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[1] The insect contents of 801 Crow stomachs were submitted to Professor Riley for examination, but in several cases where many stomachs were collected on the same day and at the same place, under precisely similar circumstances, it was not thought necessary that all should be examined critically. In such cases half or more were thoroughly examined and the results tabulated, while the remainder were passed over with a simple inspection.—W. B. B.

A detailed list of the contents of each stomach has been prepared, enumerating systematically the various species of insects found and giving the number of specimens. This list forms the basis of the following generalizations regarding the food habits of *Corvus americanus*, so far as the insects are concerned:

1. The insect food of Crows is almost exclusively composed of terrestrial species, i. e., such as are found on the surface of the ground, or hide during the daytime at the base of plants or under the various objects lying on the surface; or such as live in the dung of domestic animals, in decaying vegetable and animal matter, or underground.

There is not the slightest indication that Crows catch any insects while on the wing, and the almost complete absence of the numerous arboreal insects of all orders, i. e., such insects as are to be found on, or which live on the trunks, limbs, or leaves of trees and shrubs, indicates that the birds when sitting or resting on trees do not pick up insects.

The almost constant presence of coprophagous insects in the stomachs indicates that Crows preferably frequent dry pasture lands, dry meadows, or very open woods, where cattle or horses are grazing. In many instances the presence of certain species of *Chlænius*, water beetles, or an occasional aquatic Hemipter or a *Gryllotalpa* or *Corydalus*, etc., shows that the birds frequent the margins of ponds or streams, while in a number of other instances the presence of the larvæ of Lachnosterna, Elateridæ, etc., proves that the Crows have followed the plow of the farmer. Many of the terrestrial insects eaten by Crows abound during the warmer season in cultivated fields, more especially in corn and clover fields, and have no doubt been picked up by the birds in such localities.

2. The insect food of the Crow consists only of large or medium-sized insects; small species are only rarely, if ever, picked up. The smallest insects found are certain species of *Aphodius*. Ants form a marked exception to this rule, as small, or very small, species are frequently found in many stomachs.

3. The Crow appears to prefer insects with a hard covering to the more soft-bodied ones. Thus the number of the hard imagos of Carabidæ, Elateridæ, Scarabæidæ, Curculionidæ, and Acridiidæ enormously exceeds that of the Coleopterous, Lepidopterous, and Dipterous larvæ found in the stomachs, and no soft-bodied imagos (a few Diptera excepted) seem to be eaten. In many instances, however, this pecu-

liarity may be explained by the fact that the larvæ, as a rule, live in more hidden situations and are more difficult to find than the imagos. But Crows derive a great deal of their food from the insects living in dung heaps and dead animals where Dipterous and other larvæ abound; still these are but rarely met with in the stomachs. A marked exception to this rule is the frequent occurrence of spiders, and more especially species of the family Lycosidæ, or ground spiders.

4. It would seem that Crows have a predilection for insects possessing a pungent or otherwise strong taste or odor. This is exemplified by the prevalence of Carabidæ (among them the often recurring genus *Chlœnius*, possessing a peculiar odor), coprophilous or necrophagous Coleoptera (Silphidæ, Histeridæ, and Scarabæidæ Laparosticti), ants, and more especially by the almost constant occurrence of certain species of the Heteropterous family Pentatomidæ.

5. Finally, as a peculiarity of very little importance, may be mentioned the fact that insects of a bright, and more especially golden, color are apparently very attractive to Crows and are eagerly picked up by them. Thus *Calosoma calidum*, with its bright golden elytral spots, is met with in a large number of stomachs from various localities.[1] Very often only little elytral fragments of this species are found which would seem to indicate that the birds even pick up the elytra of dead beetles. Another striking illustration is furnished by the frequent occurrence of *Euphoria fulgida*, with its peculiar golden-green color. Other examples are the Cicindelidæ, *Pterostichus sayi*, *Geotrypes splendidus*, *Phanæus carnifex*, and others.

If we now proceed to a consideration of the insects eaten by the Crow it is at once evident that a mere list of them, comprising as it does several hundred species, is only bewildering and misleading. If all the numerous species which occur only once or at best in a small number of stomachs and in limited numbers are eliminated, and only those species are taken into consideration which occur in a large number of stomachs and most of which are represented by a very large number of specimens; finally, if we divide the latter class of insects into several convenient groups, each defined by similarity in food habits, we arrive at a certain number of clearly established and characteristic features in the food habits of the American Crow. The writer confidently asserts that, while an examination of several hundred additional stomachs would no doubt greatly increase the list of insects eaten by Crows, it would not alter, in the least, nor materially add to, the characteristic features now arrived at.

It is possible that in the extreme Southern States, as well as in the far West, some other features in the food of the Crow would appear besides those enumerated below; for only a single stomach from Florida and one from Oregon were among those submitted for examination. There were also only a few stomachs from Kansas[1] and Nebraska. Since all the other stomachs were collected at various places in the region extending from Virginia to Maine, and west to Iowa and Wisconsin, we should expect that the difference in the faunal regions would produce a corresponding difference in the food supply of the Crow. But these differences are of slight importance, and with a single exception the main features of the food of this bird remain wonderfully uniform throughout this whole region.

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[1] No traces of our common and bright-colored *Calosoma scrutator* and *C. wilcoxi* have been found in the stomachs, but this is easily explained from the habits of these species which live in the woods and are more or less arboreal, whereas *C. calidum* is strictly terrestrial and frequents pastures and fields.

The following groups of insects representing the principal food supply of the Crow are arranged according to their relative importance, but this sequence might undergo some changes if an equal number of stomachs from all parts of the country were available for examination. Of the stomachs submitted, those from Virginia, the District of Columbia, and Maryland greatly outnumber those from all other localities combined.

1. *Grasshoppers* (Acridiidæ).—During the months of May and June, i. e., during the May-beetle (*Lachnosterna*) season, grasshoppers, mostly of the genus *Tettix*, occur in the vast majority of stomachs, but with few exceptions in moderate numbers only. With the disappearance of the May beetles (toward the end of June) specimens of the typical locusts (grasshoppers—*Melanoplus* and allied genera) increase in number until in the month of August and throughout the fall they constitute by far the greatest part of the insect food, often occurring in astonishing numbers, and often forming the only insect food. Grasshoppers are also largely picked up in winter, evidently on warm days and when there is no snow on the ground.

2. *Dung beetles*.—Under this heading the following Coleoptera are comprised: Species of *Silpha* and *Hister*, the Scarabæid genera *Copris*, *Onthophagus*, *Aphodius*, and allied genera. Certain species of *Staphylinus* are also included here, which, although insectivorous, confine their operations to the droppings of domestic animals. Dung-inhabiting dipterous larvæ or their pupæ were, however, met with in only a few stomachs, and the same may be said of the larvæ of dung beetles. A larger or smaller number of these dung beetles, and more especially of the Scarabæid genera just mentioned, or at least single specimens thereof, occur in most of the stomachs from all localities and throughout the whole year, and in many instances comprise the greater bulk of the insect food.

3. *Ground beetles* (Carabidæ).—These occur likewise in the vast majority of stomachs from all localities and throughout the year, and the list of the species thus found is a very extended one. The genera most frequently present are: *Calosoma*, *Carabus*, *Chlœnius*, *Pterostichus*, *Harpa-*

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[1] Since this was written 21 additional stomachs from Kansas have been examined by Mr. Schwarz, but without essentially modifying his conclusions.—W. B. B.

tus, and *Anisodactylus.* It will be noted, however, that none of the species are ever represented by any considerable number of specimens in a single stomach. Thus the bulk represented by the Carabidæ is much inferior to that of the grasshoppers and May beetles, and probably also smaller than that of the dung beetles. Carabidous larvæ were found only in two or three isolated instances.

4. *May beetles* (*Lachnosterna*).—During a short period of the year, commencing, in the latitude of Washington, D. C., at the end of April, and in Maine and Michigan about a fortnight later, and extending toward the end of June, these beetles furnish, as regards bulk, number of specimens, and frequency of occurrence, the principal insect food of the Crow. In fact, there are only a few stomachs during this season that do not contain traces of Lachnosternas, while frequently large numbers of specimens are found in a single stomach, and this often to the exclusion of other insect food. This habit prevails throughout the whole region[1] and would occupy the foremost rank in this enumeration but for the fact that it is restricted to two months of the year.

The fact that the Lachnosterna season coincides with the breeding period of the Crow deserves to be emphasized, and the principal, but by no means exclusive, insect food of the nestlings may thus be said to consist of these Lachnosternas.

Lachnosternas are above ground only at night, when they feed on the foliage of trees and shrubs; they hide during the day underground. In determining the economic status of the Crow as an insectivorous bird it would seem to be of some importance to ascertain how and where the birds find these beetles. It may be that only those are eaten which during their nocturnal flight had been half eaten by bats and other nocturnal enemies of Lachnosterna or which had been otherwise disabled; or it may be that only those specimens are eaten which have fallen into lakes or streams during the night and which are then washed ashore in a drowned or half-drowned condition; finally it may be that the Crows are able to discover and to dig out the beetles during the day from their subterranean retreats. No direct observations on these points seem to have been made, but I have no hesitation in accepting the latter alternative, for the reason that it is an undeniable fact that the Crows find an enormous number of other insects that hide during the day under sticks, clods of earth, and other objects (e. g., many of the Carabidæ), or in the ground at the base of plants (e.g., the Curculionidæ presently to be mentioned). Many of the coprophagous insects, and more especially the genera *Copris* and *Geotrypes*, are evidently dug out from their holes beneath cattle and horse dung. This, of course, does not entirely exclude the other alternatives, and, in fact, the often recurring presence of small ants in the stomachs seems to indicate that the Crows also pick up dead or wounded Lachnosternas which are frequently covered with ants.

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[1] Even the single stomach from Kansas, collected in May (No. 15249), contains nothing except a number of Lachnosternas.

Larvæ of Lachnosterna (white grubs) were, contrary to expectation, met with in a comparatively small number of stomachs (about 20 in all, including a few where determination is doubtful), all of which were collected in the District of Columbia and adjacent parts of Maryland during the months of April and May. If a larger number of stomachs from other localities could have been examined it is possible that white grubs would play a more important rôle in the food habits of the Crow. The absence of Lachnosterna larvæ in all stomachs collected during the fall plowing season is easily explained by the great abundance of grasshoppers at this season. The few Scarabæid larvæ found in stomachs collected in the fall all belong to coprophagous species.

5. *Ground spiders* (Lycosidæ).—The only soft-bodied insects that occur in a very large number of stomachs from all localities and throughout the warmer seasons are various species of Lycosid spiders, which are so commonly met with on the ground in pastures and near water. The larger female specimens, carrying their egg sacs, appear more especially to form an attractive morsel to the Crows. The spiders are often represented in considerable numbers in the stomachs, occasionally forming the greater bulk of the insect food. Spiders of other families were but rarely met with in the stomachs, and never in large numbers.

6. *Weevils* (Rhynchophora).—Two species of weevils, *Epicærus imbricatus* and *Phytonomus punctatus*, both often referred to in economic entomology, occur abundantly in a large number of stomachs. They would play a very prominent rôle in the food supply of the Crow but for the fact that this habit is locally restricted on account of the distribution of the two species. *Epicærus imbricatus* does not extend into the Northern and Northwestern States, and the clover weevil (*Phytonomus punctatus*) is a comparatively recent importation from Europe, occurring from New York to Virginia and gradually spreading into the Northwestern States.[1] Both species are terrestrial during the day and hide in the ground at the base of plants. Other weevils possessing similar habits are not infrequently found in the stomachs, more especially various species of *Sphenophorus* (bill bugs, of economic importance), and in less numbers *Tanymecus confertus*, species of *Sitones*, *Macrops*, etc. Various other nonterrestrial weevils occur only occasionally, the most abundant among them being *Lixus concavus*.

7. *Cutworms* (larvæ of Noctuidæ).—Considering the enormous number of cutworms that occur, especially in the spring and the earlier part of summer, in pastures, dry meadows, and open fields, and considering further that cutworms hide during the day at the base of plants, under leaves, sticks, clods of soil, etc., in short, in just such places as are preferably investigated by Crows in search of food, it is remarkable that

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[1] It was never noted in Michigan prior to 1892, and it is interesting to find that there is a specimen in one of the stomachs (No. 15884) from that State, collected on May 8, 1892.

they do not constitute the largest portion of the insect food. Even if we include all other lepidopterous larvæ and pupæ found in the stomachs, this food does not by any means rank among the most prominent features. The only explanation of this fact that occurs to me has been mentioned before, viz, that the Crows greatly prefer insects with hard bodies. Still, the bulk represented by the Lepidopterous food is by no means an inconsiderable one, and the largest part is made up of Noctuid larvæ, or cutworms. These occur in many stomachs, usually singly or in very small numbers, rarely forming the bulk of the food in any one stomach and never the entire food. Noctuid pupæ were found only in isolated cases. Larvæ of the Pyralid genus *Crambus*, which live in silken tubes at the base of grasses, clover, etc., belong to the family next best represented in number of specimens, and occur in large numbers in a few stomachs. Bombycid larvæ, and especially Bombycid cocoons, come next, represented usually by single specimens. The rest of the Lepidopterous families are represented only by isolated specimens. Single imagos of Lepidoptera were found in only a few instances, and most of these are evidently specimens which had not yet issued from the chrysalis.

8. *Soldier bugs* (Pentatomidæ).—Although by no means representing a considerable portion of the insect food, the constantly recurring presence of various species of soldier bugs constitutes a characteristic feature in the food habits of the Crow. There are many species representing various families of true bugs (Heteroptera) that occur commonly on or near the ground, but, with the exception of these soldier bugs, only a few isolated specimens of a few species were found in all the stomachs. It seems probable that the strong odor or taste of these soldier bugs is the reason why they are so eagerly sought by Crows. The condition in which the specimens are found in the stomachs is also peculiar; for while the Crows generally have the habit of crushing and breaking into fragments all the hard insects they eat, these soldier bugs are almost always broken up in extremely minute particles which in the well-filled stomachs are often liable to be overlooked. Owing to this condition the exact determination of the species, as well as the determination of the number of specimens, is impossible in most cases. The soldier bugs thus found belong to *Podisus*, *Euschistus*, and allied genera.

9. *Ants* (Formicidæ).—As in the case of the soldier bugs, ants form only a small proportion of the bulk of the insect food, but their frequent occurrence in the stomachs suggests the explanation that they are relished by the Crows on account of their peculiar acid taste. Quite a number of species of various genera are represented, the largest species, *Camponotus pennsylvanicus* and various species of *Formica*, being most frequent. The presence of very small species of ants is, in many instances, probably due to accident, as has been mentioned on page 61.

The following enumeration of insects, arranged according to orders, comprises those which occurred only in a moderately large number of stomachs and usually only as single specimens, or only in a few stomachs in large numbers. Some of the insects of this class have already been mentioned.

Click beetles (Elateridæ).—A tolerably large number of species were found, but none of them represented by any considerable number of specimens. The most abundant of these species are *Limonius plebejus*, *Corymbites cylindriformis*, *Agriotes mancus*. Elaterid larvæ (wireworms) were found only in a few isolated instances.

Lamellicorn beetles.—Lucanid beetles (*Lucanus*, *Passalus*) occur occasionally, while various species of the Scarabæid genera, *Serica*, *Hoplia*, *Anomala*, *Aphonus*, *Euphoria*, and others, form in the aggregate a not inconspicuous portion of the insect food. The prevalence of *Euphoria fulgida*, or at least of little fragments thereof, in quite a number of stomachs has been already alluded to.

Tenebrionidæ.—Some specimens of the genus *Eleodes*, found in the few stomachs from Nebraska and Kansas, lead to the supposition that if a larger number of stomachs from that region could be examined specimens of this and allied genera would be found well represented. These beetles, so characteristic to the fauna of the arid region of the West, fulfill most of the requirements of insect food preferred by the Crows; they are terrestrial, large, hard, and possess a strong, offensive odor.

Ants, Bees, and Wasps (Hymenoptera).—Besides Formicids only a very moderate number of species and specimens were found, most of them belonging to the fossorial families Crabonidæ and Eumenidæ (genus *Odynerus*). Quite a number of *Polistes* also occur in various stomachs.

Flies (Diptera).—The whole order is comparatively poorly represented, and only the following families deserve mention:

Crane flies (Tipulidæ).—These are much less frequently found than one would expect from their great abundance on meadow land. Still, eggs, larvæ, and much more rarely pupæ and imagos occurred in a moderate number of stomachs. In a few instances eggs were found without any trace of the imago.

March flies (Bibionidæ).—Larvæ of this family were found only in a few stomachs, but in very large numbers. They live gregariously under decaying vegetable substances.

Muscidæ.—The small number of the various larvæ and puparia, all presumably belonging to coprophagous or necrophagous species, found in the stomachs is in striking contrast with their enormous abundance in the excrement of horses, cattle, etc., or in dead animals. Imagos of these Diptera were found only in exceptional instances.

Crickets (Gryllidæ).—Excepting the Acridiidæ, the whole order of Orthoptera is very poorly represented; the only other representatives which occur in a moderate number of stomachs are ground crickets of the genera *Gryllus* and *Nemobius*.

The orders hitherto omitted, viz, the Homoptera and Neuroptera (in the old sense), are so poorly represented as to deserve no special mention. The same may be said of the order Myriapoda, of which a few specimens of a *Julus* were found.

In order to complete this picture of the food habits of the Crow, it is important to mention briefly those families, or even single species, of insects which are of economic importance, being either injurious or beneficial, but which were not found in the stomachs examined. Only such insects are mentioned here as occur on or near the ground and of which one might expect that the Crows, at least occasionally, would pick up specimens. Some of the orders or families unrepresented, or but poorly represented, have been mentioned before and are not here repeated.

Among the Coleoptera the absence of the useful ladybirds (Coccinellidæ) deserves special mention (only a single elytron of one species has been found). Still more striking is the absence of the large family of leaf beetles (Chrysomelidæ), including the notorious Colorado potato beetle (*Doryphora* 10-*lineata*). In fact, only four species of Chrysomelidæ were found in all the stomachs (two elytra of *Paria canella*, one elytron of *Colaspis brunnea*, and a few specimens of the aquatic *Donacia flavipes*). Chrysomelid larvæ are entirely absent. Finally, the soldier beetles of the genera *Chauliognathus* and *Telephorus* in the family Lampyridæ are not represented, and only two larvæ of a *Telephorus* were found in a single stomach.

In the Hymenoptera no injurious (phytophagic) families are represented, but, on the other hand, the immense host of beneficial (parasitic) species is also almost entirely absent, only a few isolated specimens having been found. The Crow is not one of the destroyers of the honeybee, for only a single bee occurred in all the stomachs.

In the Lepidoptera, which practically do not contain any beneficial species, the absence of all cabbage worms (larvæ of *Pieris rapæ*, *Plusia brassicæ*, etc.), excepting a solitary specimen, deserves mention; also the absence of the various Sphingid larvæ and their pupæ, which infest potatoes, sweet potatoes, and tobacco. The corn worm (larva of *Heliothis armigera*) is here especially mentioned because it is said that the Crows pull out and injure the ears of corn only for the purpose of getting at the corn worms. This species has not been recognized, but it is possible that a few specimens are among the unidentifiable Noctuid larvæ.

In the Diptera the most injurious species is the Hessian fly (*Cecidomyia destructor*), but the small size of the larva and pupa, as well as their mode of occurrence, make it improbable that the Crows ever feed upon this insect, and no traces of them were found in the stomachs. The beneficial Diptera, viz, larvæ of Syrphidæ and the family Tachinidæ, are absent.

The complete, or almost complete, absence of the injurious Heteroptera forms a very striking feature. In all the stomachs examined only a single specimen of the notorious chinch bug (*Blissus leucopterus*) was found, and, unless we assume that this insect is too small, no explanation is offered why the Crow does not feed extensively upon the chinch bug, which possesses a strong odor and is more or less terrestrial in its habits. Excepting the Soldier bugs (Pentatomidæ), the insectivorous species of Heteroptera are hardly represented; the Phymatidæ are entirely absent (no doubt on account of their nonterrestrial mode of life), and of the Reduviidæ only a few specimens of a terrestrial species were found.

In the Homoptera the stomachs submitted for examination offered no opportunity for ascertaining whether or not the Crow feeds extensively upon the periodical cicada, but from the fact that in a small number of stomachs pupæ and imagos of another species of cicada were found, as well as from previous records and observations, there can be no doubt that this insect is not refused. The more or less injurious leaf hoppers (families Jassidæ, Cercopidæ, Fulgoridæ, Membracidæ), many species of which are frequently found on or at least near the ground, are not represented in the stomachs (excepting a single larva of a Fulgorid).

The only beneficial (insectivorous) family among the Orthoptera, viz, the Mantidæ, is represented in our fauna by only a few species, and none have been found in the stomachs.

No specimens of white ants (Termitidæ), the only injurious family of the old order Neuroptera, occurred in the stomachs, while of the eminently beneficial families only a single specimen of a mosquito hawk (Æschnidæ) and a single specimen of a lacewing fly (Hemerobidæ) were found.

All the families of spiders are insectivorous, but only a few are really useful to man, e. g., the Thomisidæ and the orb-weavers (Orbitelariæ). These are almost entirely absent, and the only family which is well represented (the Lycosidæ) has no economic importance.

No ticks (Ixodidæ) were found in the stomachs.

The insectivorous myriapods are not represented, being probably protected by their mode of life.

It will be seen from the foregoing remarks that among the principal insect food of the Crow there are only two classes of eminently beneficial insects, viz, the ground beetles (Carabidæ) and the soldier bugs (predaceous Pentatomidæ). The ground spiders (Lycosidæ) and the ants are, in the opinion of the writer, to be classed among the neutral or innoxious insects, which class also includes the dung insects, many of the lamellicorn beetles, and a great many of the other insects found in smaller numbers in the stomachs. All the rest belong to the injurious insects, notably the grasshoppers, May beetles (including some allied genera), the click beetles (Elateridæ), the weevils (Rhynchophorous Coleoptera), the cutworms (in fact all Lepidoptera), and the crane flies (Tipulidæ).

It is evident that the percentage of the three groups of insects forming the chief insect food of the Crow can not be determined from the number of species nor from the bulk represented by the aggregate of each species, but must be determined by the number of specimens. It is difficult to give exact figures on this last point for two reasons, viz:

1. While it is easy to determine the number of specimens of a given species where there are but few in the stomach, it is often impossible to do so where the number is great and the specimens are in the decomposed condition in which insects are usually found when in such numbers. In most instances the number could only be approximated by the number of heads or mandibles, as the remainder of the body has been essentially destroyed by digestion.

2. A large proportion of the stomachs submitted are those of nestlings, and it follows that the mere fragment of any given insect is counted in such a case as a specimen, while it is probable that a single specimen may have been given in fragments or portions by the parent to several of the nestlings, so that combined they represent but one single individual. Nevertheless the difficulties do not, in my judgment, invalidate the general conclusions arrived at, which are, that the sum total of specimens of those insects which are emphatically injurious to agriculture vastly outnumbers those which may be considered beneficial, and that it also surpasses the number of beneficial and innoxious species combined.

The facts on the whole overwhelmingly speak in favor of the Crow, and taken alone would be at variance with the prevalent opinion hitherto held and yet held regarding the economic status of the Crow as an insectivorous bird.

How far these general conclusions may be modified by the indirect nature of the food examined, i. e., by the habit of the Crow of feeding upon toads and frogs and even small birds and other insectivorous animals, I am in no position to determine. It is probable, however, that only a small proportion of the insect food of the Crow is derived in this indirect manner and that in so far the conclusions as to its economic status are not to be modified.

A complete list of the insects contained in each one of the six hundred or more stomachs critically examined would not only make the present bulletin too bulky, but the constant repetition of names would only mislead and bewilder the reader, if indeed any enthusiast would care to read it all. It is better, therefore, to omit the detailed statement of the insect remains found in each stomach and give only the general results.

TESTIMONY FROM CORRESPONDENTS RESPECTING THE INSECT FOOD OF THE CROW.

During the past ten years the division of ornithology has received statements from more than a thousand observers respecting the food habits of the Crow. So far as the insect food is concerned, most of these statements are of little value, because from the nature of the case it was impossible to tell what species of insects were eaten. Aside from such sweeping and groundless assertions as 'Crows eat no insects at all,' and 'Crows eat insects of all kinds,' scores of statements were received which were obviously incorrect, although evidently made with perfect sincerity. On the other hand, it is of interest to note how fully many of the more explicit statements are confirmed by the examination of stomachs. For example, the habit of catching grasshoppers was observed and reported by many correspondents, and the same is true of the May beetle or June beetle (*Lachnosterna*) and its larva, the white grub. The Crow's habit of following the plow was noticed more than a hundred years ago, and the principal error made by many of our correspondents lies in the assumption that the bird devours indiscriminately all the different insects thus exposed. Among the most common mistakes may be mentioned the case of the Colorado potato beetle (*Doryphora 10-lineata*), upon which the Crow was reported to feed by many observers. The fact that not a single trace of this beetle was found in any of the 909 stomachs, 500 of which were collected at times and places favoring its capture, must be taken as proof positive that the Crow rarely, if ever, touches this pest. The further fact that only four species (each represented by one or two individuals) belonging to the same family as the potato beetle (Chrysomelidæ) were found in the stomachs shows clearly that insects of this kind are thoroughly disliked by the Crow.

Following are a few examples of the voluminous testimony received from correspondents:

CALIFORNIA, *San Bernardino.*—F. Stephens: The Crow is in the habit of following the plow, picking up cutworms, white grubs, larvæ, etc., sometimes in large quantities. 1885.

CANADA, ONTARIO, *London.*—W. E. Saunders: Last summer (1885) I watched a flock of probably 2,000 crows catching grasshoppers.

CONNECTICUT, *East Hartford.*—Willard E. Treat: Worms and grasshoppers are destroyed by Crows; they eat large quantities of grasshoppers and the large white grub usually found in cornfields, especially in August. 1885.

South Woodstock.—Mrs. G. L. F. Stoddard: The Crow has been observed to feed upon cutworms and grubs that live just beneath the surface and are more readily exposed by the pulling up of the corn, which the cutworms and grubs would destroy. 1886.

INDIANA, *Brookville.*—A. W. Butler: The Crow feeds on the seventeen-year cicada. 1885.

Medora—Charles Eshorn, jr.: I have noticed them every season walking over a meadow just after the hay has been cut, catching grasshoppers, but I have never noticed them hunting insects in a meadow after the grass was 2 or 3 inches high, and of course from that time until it is cut is the time that insects damage it most. 1892.

Nebraska.—J. D. Kuster: Crows have fed extensively on locusts this year. 1885.

IOWA, *Wapello.*—D. C. Beaman: It will feed on all kinds of grubs and worms which are thrown out by the plow. 1886.

LOUISIANA, *Abbeville.*—W. W. Edwards: I nave not observed them eating any insects except the larvæ and grubs, on which they feed extensively in the spring on fresh-plowed ground. I am not able to say what larvæ they feed on. 1886.

Bayou Goula.—W. C. Percy: It has been observed to eat locusts, but I have never been able to find any other insect in its stomach except grubs, etc. 1885.

MAINE, *North Livermore.*—George H. Berry: The Crow eats grasshoppers, potato bugs, and *Clisiocampa* larvæ. 1886.

MASSACHUSETTS, *Amherst.*—Hubert L. Clark: I believe that the Crow is largely insectivorous. It frequents marshes and open fields in search of food in large flocks, where it destroys large quantities of grubs, particularly those of the common June bug (*Lachnosterna fusca*), grasshoppers, and locusts. It also destroys cutworms. 1885.

East Templeton.—Charles E. Ingalls: I have seen the Crow eat grasshoppers and have also seen it feed on a large white grub taken from the ground in old fields. 1885.

MICHIGAN, *Hudson.*—A. H. Boies: I have often observed it seeking for grubs and other larvæ in the spring, and know that it is a great destroyer of such when other forage is scarce. 1885.

Lickleys Corners.—A. H. Carver: I have known them to follow the plow in the spring and pick up cutworms and the large white grub. 1886.

Thornville.—John S. Caulkins: The following statement relative to Crows eating cutworms was given me by a friend, William B. Sutton, of Lapeer. He said he had plowed and dragged a piece of old sod and noticed that a flock of Crows were frequenting it. Sharing to some extent the hostility the farmers generally feel toward the Crows on account of the damage they do to corn, he concealed himself with his loaded shotgun in a corner of the fence, close to where the Crows worked, thinking to shoot a few and hang them up as a terror to the rest. When the crows came he distinctly saw them turn over the sods, shake them to pieces, and eat the cutworms that fell out. He came away without shooting, and since then has been the professed friend of the Crow. 1886.

NEBRASKA, *London.*—George A. Coleman: In May and June we find him following the plow, seeking earthworms, insects, and mice. His favorite food is the larva of the June bug (*Lachnosterna fusca*), which he finds in great abundance. 1888.

NEW HAMPSHIRE, *Webster.*—Charles F. Goodhue: At this season Crows are of some benefit to the farmer, as they feed mostly on grasshoppers. To-day (August 22, 1885), a flock of nearly 100 were observed in a pasture badly infested with grasshoppers, upon which they were evidently feeding.

NEW JERSEY, *Merchantville.*—Edward Burrough: The Crow ought not to be condemned for it is one of our best insectivorous birds. It eats the June bug and the larvæ of any insect plowed up in the spring, such as white grubs and cutworms. 1886.

NEW YORK, *Alfred Center.*—F. S. Place: Crows destroy insects. Several specimens taken by me last spring (1886) had their stomachs filled with insects, mostly Coleoptera.

Boonville.—Morris M. Green: Near Boonville I have seen the Crow feeding on grasshoppers during the summer months. Some fields seemed to be fairly black with the birds pursuing the grasshoppers in every direction. One day, noticing a flock of Crows frequenting a particular field, I visited the place and found that the roots of the grass had been completely eaten away, so that the sod or turf could be rolled up like a rug or carpet. A farmer living in the vicinity told me that the Crows visited the place every day to feed upon the grubs that destroyed the turf. The grubs or larvæ were about three-fourths of an inch in length; body whitish, with some dull plumbeous underneath; head blackish. I think these are the kind so often found in corn hills and which do much damage to the corn. If so, this speaks a good word for the Crow. 1887.

Waverly.—S. J. Wolcott: Crows in the springtime feed largely on cutworms, both on sod lands and after the same have been plowed. I have known them to work on cutworms in my tobacco field. After setting, when the worms are cutting the young plants, the Crows are there every morning, and no doubt destroy great numbers of them. They have been reported to eat potato bugs to some extent, but I am not prepared to verify the statement. 1892.

NORTH CAROLINA, *Pittsboro.*—E. T. Adney: It eats a great many insects, particularly grasshoppers. 1885.

OHIO, *Wakeman.*—W. B. Hall: Crows are decidedly insectivorous if domestication does not alter their habits. At different times I have kept Crows which were taken from the nest when nearly full fledged. They became very tame, so that I had a chance to watch their actions and manner of feeding. I find that they are not particular in their diet as to whether the insect is injurious or beneficial. They feed greedily on the different species of cutworm (*Agrotis*) and on the white grub (larva of *Lachnosterna fusca*). When plowing they will follow in the furrow and pick up every grub or beetle in sight, and when their appetites are satisfied they fill their beaks with insects and hide them under sticks, leaves, or stones. I have often taken the pains to look up their hiding places and count the insects thus hidden, and I have been astonished at their numbers. They kill predaceous beetles, but do not often eat them, I think on account of the peculiar odor most of them emit. For the sake of experiment, I have taken the Crows to a board or stone which, on being removed, exposed many black beetles (mostly *Galerita*). They would pounce on a beetle, give it a pinch through the head or thorax, drop it, and seize another with such rapidity that but few, if any, escaped. I could not on any condition tempt their appetites with Colorado beetles, squash bugs, cucumber bugs, or any of the soldier bugs or ladybirds (*Coccinella*). I had a male Crow that would eat the cabbage caterpillar (*Pieris rapæ*) with evident relish, while his mate disdained such plebeian diet. They would kill the sow bugs (*Oniscus*) and species of Myriapoda, but would not eat them.

Wauseon.—Thomas Mikesell: It feeds on cutworms, May beetles, white grubs, chinch bugs, and eggs of grasshoppers. These form its principal food. 1885.

Waverly.—H. W. Overman: It is a lover of grasshoppers and destroys great numbers of them, especially in the fall. 1885.

OREGON, *Dilley.*—George S. Johns: It feeds extensively on grasshoppers and crickets. 1885.

PENNSYLVANIA, *East Brook.*—T. Scott Fisher: I watched a pair of Crows follow me day after day last spring (1886) while plowing sod, and have seen one Crow pick up 25 to 40 white grubs, cutworms, and wireworms at one time, and then fly to the woods for an hour or so, then back again.

Philadelphia.—J. Percy Moore: When the seventeen-year cicada appeared this summer (1885) the Crow fed extensively on both its pupæ and imagos. The young were fed, to some extent, on the pupæ (May 30, 1885). As they had not at this time appeared above the ground, I suppose the Crows obtained them in plowed fields. On June 17 I noticed them feeding on the adults. I have seen Crows feeding in plowed fields before the grain was planted (March 10, 1885), and I think they were feeding on the larvæ of the June bug or other beetles which live in the ground. I have also seen them eat large ants which live on trees and burrow into the wood (July 1) and other species of insects which I was not able to identify from a distance.

VERMONT, *Hydeville.*—A. I. Johnson: Crows catch countless numbers of crickets and grasshoppers after the hay is cut. They can be seen almost any time of day on the meadows catching grasshoppers. I observed one pair of old Crows this summer, when I was haying, that were feeding their young almost entirely on grasshoppers; the old Crows would alight on the mown land within 8 or 10 rods of me, and after catching a hopper or two would fly to their young that were on a fence and there feed them. Of all our birds, the Crow, I think, is the most extensive feeder on grasshoppers. 1885.

West Pawlet.—Frank H. Braymer: It has been observed to feed to a certain extent on the cankerworm, cutworm, various kinds of grasshoppers, and small beetles. Probably the benefit derived from the destruction of insects is considerable. 1885.

VIRGINIA, *Birdsnest.*—C. R. Moore: Crows follow the plow in the spring and eat many cutworms, and probably other insects, but I only know positively of cutworms. 1886.

Drewrys Bluff.—A. R. Bellwood: During at least ten months of the year in this part of the country large numbers congregate on the pasture fields, meadows, and plowed land, and remain for hours searching for larvæ and insects. 1891.

Fork Union.—J. B. Underhill: As to the insect diet of the adult I can not testify, having never examined the gizzards. The gizzards of two young which were taken from the nest were filled to overflowing with grasshoppers, and each contained one or two kernels of corn. 1886.

Lick Run.—J. G. Paxton: The Crow has been destroyed by poisoning until it is now nearly exterminated, and there is a noticeable increase of insects of every kind. It eats insects more or less, except the Colorado potato beetle. 1885.

WISCONSIN, *Clinton.*—C. N. Crotensburg: I have never known the Crow to refuse any insect except bees, of which it is exceedingly shy.

CHAPTER IV.

VEGETABLE FOOD OF THE CROW.

As already shown, the vegetable food of the Crow amounts to about 57 per cent of the whole food. Of this, corn is of the greatest importance to the farmer, since its destruction is one of the most serious charges made against this bird. But in addition to corn the Crow feeds on several other kinds of grain and also on mast and many fruits and seeds.

The following table shows the various vegetable substances found in Crows' stomachs and the percentage of each to the whole vegetable food for each month:

Table showing the kinds of vegetable food found in Crows' stomachs and the percentage of each, arranged by months.

Month.	Number of stomachs examined, 909.	Corn.	Wheat.	Oats.	Barley.	Unidentified grain.	Buckwheat.	Wild rice (*Zizania*).	Grass and weed seed.[1]	Unidentified seeds and fragments.	Acorns.	Chestnuts.	Beechnuts.	Palmetto and pecan nuts.	Cherries.	Wild cherries.	Strawberries.	Blackberries and raspberries.	Mulberries.
January	53	28.5	2	1.9	....	....	....	0.9	2.1	2.1	4.7	....	....	1.1	....	....	....	....	....
February	23	39.4	1.7	2.9	....	....	....	4.2	....	....	9	....	....	....	....	....	....	....	....
March	26	15	1	7.9	....	1.8	5.1	6.5	1.7	T[2]	9.4	....	2.9	2.7	....	....	....	....	....
April	42	15.6	.6	2.4	....	....	1.6	T	T	.4	.7	....	....	....	....	....	....	....	....
May	364	17.7	.5	.4	....	.9	.2	T	T	T	.8	T	.4	....	0.2	....	T	T	....
June	165	14.3	.6	2.2	1	3.6	1.4	T	T	.2	.6	....	T	....	10.5	....	1	.5	1.3
July	45	8.4	8.3	2.7	....	2.6	....	....	.6	.2	3.2	....	....	....	10.2	2	3	4.6	.1
August	24	11.4	9.5	3.8	....	2.2	....	....	....	....	....	....	....	....	....	6.6	....	2.3	....
September	44	24	2.4	.9	....	1.6	.7	T	T	....	3.2	T	....	....	....	3.3	....	.1	....
October	46	18	2.8	.1	....	1.9	....	....	.1	....	15.6	2.2	.4	.3	....	.2	....	....	....
November	18	17.8	1.4	3	....	1.1	....	....	.1	....	9.7	1.3	....	....	....	....	....	....	....
December	59	48.2	.7	1.1	....	.5	....	.4	.4	.3	3.9	.9	1.1	....	....	....	....	....	....
Percentage of total food of year	....	21.5	2.8	2.4	T	1.4	.8	1	.4	.3	5.1	.4	.4	.3	1.7	1	.3	.6	.1

Month.	Elderberry (*Sambucus*).	Blueberries and huckleberries.	Juneberry (*Amelanchier*).	Bull berries (*Shepherdia*).	Pokeberry (*Phytolacca*).	Grapes.	*Ampelopis.*	*Viburnum.*	Cornels.	Sour gum (*Nyssa*).	Holly, cat brier, Barberry, cedar.
January	....	....	....	....	....	....	....	....	....	....	trace.
February	....	....	....	....	....	....	....	....	....	....	0.5
March	....	....	....	....	....	....	....	....	....	....	....
April	....	....	....	....	....	....	....	....	0.9	....	trace.
May	....	....	....	....	....	....	....	....	trace.	....	....
June	0.3	....	0.4	....	....	....	....	....	....	....	trace.
July	.2	2.3	.3	....	....	....	....	....	....	....	....
August	1.2	1.8	....	....	0.2	9.7	....	....	1.7	....	....
September	....	....	....	3.9	.3	13.9	trace.	....	2.6	1	.1
October	....	....	....	....	.3	5.1	0.7	0.4	1.9	....	trace.
November	....	....	....	....	....	.3	1.1	....	2.5	.2	....
December	....	....	....	....	....	.1	....	....	.5	....	1
Average	.1	.3	.6	.3	trace.	2.4	.2	trace.	.8	.1	.1

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[1] The seeds included here are: *Amarantus*, *Ambrosia*, *Trifolium* (clover), *Malva*, *Polygonum*, *Rumex*, *Setaria*, and grass seed unidentified.

[2] T = trace.

Table showing the kinds of vegetable food found in Crows' stomachs and the percentage of each, arranged by months—Continued.

Month.	Bayberry (*Myrica*).	Nonpoisonous sumac.	Poison *Rhus*.	Apple pulp and seeds.	Cucurbitaceous seeds or pulp.	Fruit not identified.	Potato pulp.	Tubers or roots undetermined.	Mushrooms.	Rubbish.
January	......	6.6	3.9	0.2	1.6	0.3	......	......	......	4.9
February	......	10	.6	......	1.7	......	......	......	......	.7
March	......	.9	......	1.2	.3	......	......	2.6	......	7.2
April	0.5	.7	......	.1	......	2.5	......	......	......	5.2
May	......	trace.	......	......	trace.	.3	......	trace.	......	6.4
June	......	trace.	trace.	......	.7	.8	0.9	......	......	4.8
July	......	......	......	......	1.1	.1	1.1	......	0.7	4
August	.7	......	.5	3.8	......	.5	......	......	......	1.5
September	.9	......	3.4	.4	......	.3	......	......	......	1.7
October	1.6	......	8.5	......	.2	.6	......	......	......	3.5
November	4.3	4	6	.9	......	......	......	......	......	2.4
December	......	5.1	4	......	trace.	......	......	.5	......	5
Average	.7	2.3	2.2	.6	.5	.5	.2	.3	.1	3.9

CORN.

Corn is an important crop in nearly every State and Territory of the Union, and in many States the area devoted to it exceeds the combined areas of all other cereals. The crop of 1892, though below the average of recent years, amounted to 1,628,464,000 bushels, and the area planted was 70,626,658 acres. Throughout most of the region from which Crow stomachs were obtained the acreage of corn was far in excess of the general average for the United States. In Maryland, for example, in 1892 one-tenth of the entire land area was planted in corn. In Ohio the acreage was somewhat greater proportionally, and in Iowa, the greatest corn State in the country, about one-fifth of the entire area of the State was given to corn. In other years these figures have been exceeded. It is evident, therefore, that except under the most unusual circumstances corn must be readily accessible to Crows in all parts of the country from the time of planting until harvested and housed.

In many places cornfields are more or less protected from the attacks of Crows during the time of planting and until the corn is too large to pull, but most attempts at protection are only partially successful, and as a rule such efforts are confined to newly planted fields, no attempt being made to keep Crows away from corn in the milk, or at any later stage. Under these circumstances, if Crows were extraordinarily fond of corn it might be expected to form a very large part of their food during that portion of the year when it is most accessible.

The general impression that the Crow likes corn under all circumstances is a mistake. Crows certainly eat considerable quantities of corn during every month in the year, but, as shown further on, they are not fond of ripened corn, and only eat it when more desirable food is scarce. It must be remembered that for several months in the winter the Crow's life is an almost continuous struggle for existence, and there are times almost every winter when the customary sources of food supply are temporarily cut off by deep snow or excessive cold, or become entirely exhausted, compelling the Crow to resort to any shift which will keep him alive. Moreover, the evidence accumulated in the past few years shows clearly that the Crow is primarily a carnivorous bird. A small proportion of vegetable food is doubtless eaten with relish at all seasons, but the larger part is probably taken from necessity and not from choice, and it seems certain that a very large part of the corn eaten in cold weather is taken for the same reason. A caged Crow which was kept for several months in the winter of 1889 and 1890 invariably refused hard corn, either whole, cracked, or ground, so long as animal food of any kind was to be had, and it was only after many hours of absolute fasting that he turned voluntarily to grain of any kind. The Crow is fond of sprouting corn, and delights to pull up the young shoots as they come through the ground. When corn is in the milk, and the kernels are well filled out but still soft, the Crow seems very fond of it, and sometimes does considerable damage before the grain hardens. But after the kernel becomes fairly hard the Crow no longer seems to relish it, and cases of serious damage to ripened corn are extremely rare.

Probably the damage to sprouting corn and corn in the milk is much lessened by the fact that at the seasons when these are obtainable other food of the most attractive kind is superabundant. This is true particularly of the season when corn is in the milk, for during July, August, and September both animal and vegetable food are at their maximum, and except during the early part of July all Crows are self-supporting, the young being large enough by that time to provide for themselves. The damage to sprouting corn is done mainly in May and June, at which time most Crows have young in the nest and are compelled to provide them with food, besides finding food for themselves.

Keeping these facts in mind, the results of the stomach examinations will be perfectly intelligible, and some of the facts brought out acquire special significance.

Nine hundred and nine stomachs which contained food were examined, and 444 of these, or about 49 percent, contained corn, the average amount being about 40 (40.49) percent for the 444 stomachs, or 21.5 percent for the whole number.

The table which follows shows the number of stomachs for each month, the actual and proportional numbers containing corn, and the average quantity of corn for each month.

TABLE I.—*Showing corn in Crow stomachs.*

Month.	Number of stomachs examined.	Number containing corn.	Percentage containing corn.	Average percentage of corn in stomachs containing it.	Percentage of corn to total food of species.
January	53	29	54.7	52	28.5
February	23	16	69.5	56.7	39.4
March	26	11	42.3	35.5	15
April	42	16	38.1	40.9	15.6
May	364	201	55.2	32.1	17.7
June	165	62	37.6	38	14.3
July	45	10	22.2	37.9	8.4
August	24	6	25	45.7	11.4
September	44	20	45.4	52.7	24
October	46	17	36.9	48.6	18
November	18	10	55.5	32	17.8
December	59	46	77.9	61.9	48.2
Total	909	444	* 49	* 40.49	* 21.5

* Average.

Since the food of Crow nestlings differs in several particulars from that of adult Crows, the two following tables have been prepared showing the amounts of corn eaten respectively by adult Crows during the entire year and by Crow nestlings in April, May, June, and July:

TABLE II.—*Showing corn in stomachs of adult Crows.*

Month.	Number of stomachs examined.	Number containing corn.	Percentage containing corn.	Average percentage of corn in stomachs containing it.	Percentage of corn for all stomachs.
January	53	29	54.7	52	28.5
February	23	16	69.5	56.7	39.4
March	26	11	42.3	35.5	15
April	17	10	58.8	60.1	35.3
May	69	52	73.9	51.6	38.9
June	84	28	33.3	46.4	15.2
July	45	10	19.5	42	8.2
August	24	6	25	45.7	11.4
September	44	20	45.4	52.7	24
October	46	17	36.9	48.6	18
November	18	10	55.5	32	17.8
December	59	46	77.9	61.9	48.2
Total	508	255	* 51	* 51.5	* 25

TABLE III.—*Showing corn in stomachs of nestling Crows.*

Month.	Number of stomachs examined.	Number containing corn.	Percentage containing corn.	Average percentage of corn in stomachs containing it.	Percentage of corn for all stomachs.
April	25	6	24	9	2.2
May	295	149	50.5	25.3	12.8
June	81	34	42	31.1	13.1
Total	401	189	* 47.1	* 25.8	* 9.3

* Average.

It appears from these tables that corn forms about one-fourth (25.9 percent) of the food of adult Crows, and less than one-eighth (12.2 per cent) of the food of Crow nestlings.

The last column of the table, giving the percentage of corn eaten by adult Crows in each month, shows that the quantity is very large during the season of planting and sprouting,—which season, in the region from which most of the stomachs came, covers the latter part of April and part of May.[1] In midsummer (July and August), on the other hand, the percentage falls to the lowest point reached during the year. At this season no sprouting corn is available and the coming crop is too young to be eaten. During July, too, the available waste corn is at its minimum, while animal food is superabundant. Small fruits, both wild and cultivated, also abound at this season, so it is not surprising that the percentage of corn is very low. During August and September there is a marked increase in the amount of corn eaten, and much of it is soft (i.e., in the milk) and a direct loss to the farmer. In October the ratio still increases, but apparently falls away again in November; but the number of stomachs collected during this month is too small to serve as a safe criterion. In October and November chestnuts, beech nuts, and acorns commonly abound and furnish an ample supply of vegetable food. In fall, winter, and early spring the corn eaten is waste grain, and its consumption entails no loss to the farmer.

According to the stomachs examined for May, 38.9 percent of the food of adult Crows and 12.8 percent of the food of nestling Crows during that month consisted of corn. Taking young and old together, the percentage is 17.7. In the case of the nestlings the number of stomachs (nearly 300) is sufficient to give a trustworthy result, but in the case of the adults (only 69) it is too small.[2] Furthermore, nearly all of the adults were collected in localities where corn is the dominant crop and easily obtained. A large proportion was doubtless pulled from the ground soon after coming up and hence was a direct loss to the farmer. But this loss, as shown later, may be prevented by tarring the seed corn.

It is a prevalent belief among farmers that sprouting corn is taken chiefly to feed the young in the nest, and many think that the old Crows would not pull corn at all were it not for their young. The stomach examinations show this belief to be largely, if not entirely, unfounded. Table III shows that the average amount of corn in the stomachs of Crow nestlings is only half as great as in the stomachs of adults taken at the same time. As a matter of fact, young Crows for the first fortnight are rarely fed any corn at all, nearly all the food given them being animal. This is in accord with what is known of other birds that are general feeders, and might have been predicted after the essentially carnivorous habits of the adults were established.

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[1] In April a considerable part of the corn eaten must be waste corn, since in the latitude of Washington, D. C., comparatively little is planted until the latter half of this month. Farther south the planting is earlier, and the young corn is available at a correspondingly earlier date, but very few of the stomachs under consideration were taken south of Maryland.

[2] This is equivalent to 12.9 per cent of the total quantity of corn eaten during the year, or a trifle over 2 per cent of the total food. Hence, admitting that all the corn eaten by adult Crows in May is sprouting corn, which of course is not the case, the loss would amount to only 2 per cent of the food of the Crow. If young and old are taken together the percentage is even less, exactly 1.6 per cent.—C. H. M.

Almost invariably the stomachs of very young Crows were devoid of any trace of corn, while the stomachs which contained large quantities were those of birds at least half grown, and in many cases described by the collectors as 'full fledged,' 'ready to leave nest,' or 'already out of nest.' Young birds of this size are apt to call continually for food, and their parents are compelled to work industriously to keep them alive.

In the case of corn in the milk the quantity destroyed is even less than that of sprouting corn. Allowing a month (middle of August to middle of September) as the average period when corn is in the milk in the region from which most of the stomachs came, it is found that less than 7 percent of the corn, or less than 2 percent of the total food, is corn in the milk.

Testimony from observers respecting the destruction of corn.—The following extracts from correspondents are selected from a large number.

From Charles Eshorn, jr., Medora, Ind., 1892:

> Crows destroy a great deal of corn in this section of the country, both at planting and roasting-ear time. Just after the young corn shoots (or sprouts) are through the ground, the crows pull up a great many grains, often damaging a field so much that it must be replanted. The extent of the damage done in this way is about 5 per cent. But they do most mischief while the corn is in the milk. They tear away the husks from the end, but rarely eat more than two or three dozen grains from each ear, but they tear open as many as a dozen ears in one day. An ordinary flock of 40 or 50 Crows feeding on a field of corn for a week, each Crow damaging 12 ears per day, would do considerable damage—say 5 percent.

From Dr. M. McKenzie, Centerville, Reynolds County, Mo., 1889:

> As to corn, they take it from the time it shows above ground till there is no vestige of grain at its roots, then rest till it begins to silk; then they begin to tear the shuck, and keep at it as long as left in the field, doing more damage by the torn ear taking water and rotting than what they eat, although they eat lots. I had to replant three times, and then did not get a stand.

From A. R. Bellwood, Drewrys Bluff, Va., 1891:

> In the spring they settle in large flocks on the newly sown fields and eat the grain that has not been covered. They commit the greatest havoc in the cornfields, beginning to pull it out as soon as any of the corn is up, and continuing until it is 3 or 4 inches high. When the sprout breaks off they rapidly dig the earth from over the grain and secure it even though it be quite deep. In this manner a small number of Crows do a great amount of damage. * * * In the fall, before the corn has become hard, large flocks often alight on the largest ears and tear the husks from the upper side near the end. They not only devour the corn, but leave the ear so exposed that the rain gets under the husk and rots a large portion of what they do not eat. Some farmers have told me that they only interfere with the ears that contain worms, but I know with certainty that such is not the case.

WHEAT.

Wheat occurred in 43 stomachs out of the 909 examined. The average quantity in the 43 stomachs was 32 percent, although the average for the year was only 2.63 percent. The largest amount was eaten in July, when it occurred in 10 stomachs, or in about 1 stomach in 4½, and the average quantity for the month was 8.33 percent, thus approaching corn in importance. In August, 1 stomach in every 6 contained wheat, and the average for the month was 9.05 percent, slightly in excess of that for July. These two months, however, are the harvest months for wheat, and although the amount eaten at this season is naturally greater than at any other time, it does not follow that much harm is done, since the birds probably get very little grain except what has been shaken out during harvest. It is safe to assume that nine-tenths of all the wheat eaten by Crows is waste, the consumption of which is no loss whatever to the farmer. Stomachs taken in January contained only about 2 percent of wheat, and those in October not quite 3 percent.

Some observers say that Crows pull sprouting wheat in the fall as well as in the spring; but the damage thus done must be trifling, for very few complaints have been received.

OATS.

Oats occurred in 45 stomachs out of 909. The average quantity for the 45 stomachs is 30 percent, although the average for the year is 2.42 percent. Crows damage oats very slightly, since, as in the case of wheat, the grain eaten is for the most part waste. There is no increase in the quantity taken during harvest, and singularly enough the largest consumption of oats, as shown by the tables, is during the month of March, when the average reaches 7.88 percent. The next highest average is for August (3.75 percent), when 1 stomach in every 8 contained oats. The averages for February, April, June, and July range from 2 to 3 percent, and during the remainder of the year the amounts were less. The source of most of this grain is undoubtedly 'road pickings.' In other words. the supply is almost entirely derived from the droppings of horses and cattle. This fact, suspected long ago, receives ample confirmation from the presence in Crow stomachs of large quantities of coprophagous or dung-eating insects, and anyone who has carefully watched Crows in the fields knows with what regularity they avail themselves of this source of supply.

BARLEY.

Barley was not found except in the month of June, and occurred in two stomachs, in each of which it formed 80 percent of the contents, giving an average for that month of about 1 percent of the food.

BUCKWHEAT.

Buckwheat occurs with some frequency in Crow stomachs, but, doubtless owing to the fact that it is not widely cultivated, the proportion is very small. Only 17 stomachs out of 909 contained buckwheat, and the average for the year was less than 1 percent. Only in March was it present in sufficient quantity to be noticeable. In that month it formed a little over 5 percent of the entire stomach contents. This was due probably to the fact that the stomachs came from a region in which buckwheat happened to be abundant and the refuse seed was picked up in the fields soon after the snow melted. There is little to indicate that the Crow ever attacks growing or ripening buckwheat.

It is significant that among the various weed seeds picked up in small quantities by Crows species of the buckwheat family (*Polygonaceæ*) outnumber most other kinds. This probably is not due to any particular fondness for these seeds, but simply to the fact that they are abundant in waste places and most of them are shining black seeds of considerable size.

MAST.

About 6 percent of the total contents of Crow stomachs consists of mast—acorns, chestnuts, beech nuts, pecan nuts, and similar food. The order in which these items have been mentioned indicates their relative importance, but of the entire amount at least five-sixths is made up of the remains of acorns, while chestnuts and beech nuts form two-thirds of the remainder, and pecan nuts and palmetto nuts, occurring only in a few stomachs from Southern localities, make up the rest. Acorns in Crow stomachs reached their maximum in October, when they formed 15½ percent of the contents of the stomachs examined. In November the percentage fell to 9¾; in December to about 4, with a slight increase in January, while in February this average was doubled, and in March it reached almost 9½.

These figures naturally reflect the conditions of the food supply. In October most acorns ripen and fall, and the Crows easily obtain large quantities either directly from the trees or from the ground. By the middle of November few acorns are left upon the trees, and the fallen leaves have hidden part of those on the ground. In December and January snow usually covers the ground, and the supply of acorns must be obtained from places swept bare by the wind, from edges of streams, and springy places where the snow does not accumulate, or from the bare ground during occasional thaws. A large proportion of the Crow stomachs taken in December and January were collected during snowy weather, when such food must have been extremely hard to find. In February and March the melting snow again exposes the acorns, which are all the more acceptable from the fact that the cornfields have been so carefully gleaned already.

It is remarkable that in spite of the abundance of fruit and other soft vegetable food Crows continue to find and eat acorns all through the spring and early summer. The quantity eaten is small during most of this time, but some at least are found in every month except August, while in July the average exceeds 3 percent. This surely indicates considerable skill and diligence in hunting out the old acorns which have lain hidden so long. It is by no means impossible that Crows, in times of scarcity, draw upon hoards of food hidden by themselves or by other animals during seasons of plenty. Crows in confinement or in a state of semidomestication are notorious thieves, hiding everything for which they have no immediate use. In a wild state, too, they have been seen to carry off acorns in their bills, and at least some of these are presumably hidden or buried in the ground. This habit or instinct is common in some degree to most, if not all, members of the Crow family (*Corvidæ*), and in some of our American jays it is strongly developed.

Young Crows in captivity not only pull up corn on first sight, but some of them appear to have a veritable mania for pulling up any young growing sprout. During the summer of 1893 I saw a pet Crow spend nearly half an hour in attempting to root up a sturdy young oak of two years' growth, and failing in this he made similar ineffectual efforts to pull up the cane to which the little oak was tied to keep it straight. Finally, in apparent anger at its repeated failures, it began to pull off the leaves of the little tree, tearing them viciously and throwing the pieces aside. The same Crow made frequent visits to a piazza where were some potted plants, one of which he always pulled up, no matter how often it was replanted. After this had been repeated ten or twelve times the Crow carried away the plant, and it was never seen again.

GRASS AND WEED SEEDS.

Almost every Crow stomach taken in winter contained remains of grass or weed seeds. The quantity, however, was usually so small as to be entirely insignificant. It is only natural that a bird which gets almost all its food from the ground should pick up a few small seeds every day. In some cases considerable numbers of seeds were found in the stomachs, but in no case were they of great importance. The presence of seeds of various knotweeds (*Polygonum*) has been noticed already; next in abundance should be mentioned the bitter weed or ragweed (*Ambrosia artemisiæfolia*). The seeds of several other kinds of ragweeds also occur, notably the giant ragweed (*A. tridentata*). In addition to these a few stomachs contain seeds of amaranth (*Amarantus*), clover (*Trifolium*), mallow (*Malva*), foxtail grass (*Setaria*), and other grasses. Amaranth seeds are so universal and abundantly distributed in waste places that the few consumed by Crows can not have any effect in lessening the abundance of the weeds. The same probably is true of ragweed (*Ambrosia*), knotweed (*Polygonum*), and dock (*Rumex*). An examination of the castings of Crows at the roosts showed that a considerable number of seeds of the giant ragweed appeared to be indigestible and had been ejected with the other indigestible matter of which the castings are composed. It is possible that such seeds may not have lost their germinating power, but even in that case the number thus distributed would be small and the effect of no great importance. The average of grass and weed seeds for the year was less than half of 1 percent.

Fragments of seeds and a few seeds impossible to identify occurred in perhaps a dozen stomachs, but the total amount was only about one-fourth of 1 percent of the food for the year.

WILD RICE (*Zizania*).

Wild rice appears to be relished by the Crow, especially during winter, but the localities where it is available are limited. Almost all the stomachs containing wild rice were from Crows killed in the vicinity of Washington, D. C. Here are extensive wild-rice marshes, and at all times of the year the seed may be found on the mud flats or washed up along the banks of the Potomac. Before congregating at their nightly roosting places the Crows often assemble by thousands on these mud flats, and small flocks may be seen there at any time, picking up bits of food that attract their attention. It is doubtless at these times that most of the wild rice is discovered and eaten. It has, therefore, absolutely no significance from an economic point of view. All that is eaten is promptly digested, and the Crows therefore never distribute the seeds broadcast, as they do those of many small fruits and climbing vines. The average amount of wild rice in the stomachs for the entire year was 1 percent.

FRUIT.

The Crow is not generally regarded as a fruit eater, and the common verdict is fairly sustained by the evidence from the stomachs. About one-sixth of the food appears to consist of fruits, wild and cultivated, of which less than one-fourth is of any consequence to man.

Judging from the results of stomach examinations, the cultivated fruits most often attacked are grapes, cherries, strawberries, raspberries, blackberries, apples, pears, and watermelons, but from the nature of the case it is often impossible to say whether the remains are of wild or cultivated fruits. Apples and watermelons can be assumed to be cultivated, but of these fruits the Crow ordinarily takes the pulp only, and this is likely to escape detection in the stomach.

By considering the several fruits singly their relative importance, as well as the uncertainties attending the estimation of amounts, will be more readily appreciated.

Grapes.—Grapes were found in Crow stomachs only during the last five months of the year, and the quantity eaten in November and

December is insignificant. In August, however, it exceeds 9½ percent of the entire stomach contents; in September it amounts to almost 14 percent, and in October to 5 percent. Just what proportion of this fruit is cultivated it is impossible to say. Wild grapes are abundant in every section of country from which the stomachs came, and in many cases the seeds found were positively identified as those of the frost grape (*Vitis cordifolia*) and fox grape (*V. labrusca*), while other kinds were recognized more rarely. On the other hand, several Crows were shot while leaving vineyards of Concord grapes, and occasional complaints have been received from grape growers in different sections of the country. It is probable, however, that the Crow usually contents himself with wild grapes and is not likely to become a serious pest in vineyards.

Cherries.—In the case of cherries there is less likelihood of confounding wild and cultivated forms, since the seasons of ripening are usually different. In most localities cultivated cherries have ripened and disappeared before the wild species have begun to ripen. Moreover, the pits or stones of cultivated species usually may be identified with some degree of certainty. Nevertheless in many of the older settled parts of the country several varieties of introduced cherries have escaped from cultivation and now fruit abundantly in a wild state. This is the case in the Lower Hudson Valley, and most of the Crow stomachs collected in the vicinity of Sing Sing, N. Y., in June and July contained parts of such cherries. Reference to the table shows that in June and July at least 10 percent of Crow food consists of cherries, the larger part undoubtedly cultivated. It should be noted that from New Jersey southward, especially near the coast, the Fish Crow (*C. ossifragus*) is more or less abundant, and there is reason to believe that it is much more strongly addicted to fruit stealing than the common species. It is very similar to the Common Crow in general appearance, but is smaller (especially light in weight), with longer toes, and thus better fitted for arboreal feeding.

It is probable that at least half the damage attributed to Crows in the coast region of the Southern States is done by the Fish Crow, and as regards fruit eating, probably a much larger proportion should be charged to it.

Wild cherries, principally *Prunus serotina*, form an important item of the Crow's diet during August and September, and some are eaten during the latter part of July. The maximum, 6½ percent, is reached in August, and after September only an occasional cherry stone appears in the stomach contents. In addition to the species mentioned, remains of the small wild red cherry (*P. pennsylvanica*) were found in one or two stomachs, and stones of the choke cherry (*P. virginiana*) were not uncommon. One Crow, taken on Long Island, New York, had eaten beach plums (*Prunus maritima*).

Strawberries evidently are eaten freely by Crows, but owing to the indefinite number and small size of the seeds it is difficult to estimate the proportion in which they enter into the food. In June they form about 1 percent of the food, in July nearly 3 percent. During June and July the majority of stomachs examined contained remains of this fruit, but almost invariably these appeared to be wild berries. In a few instances cultivated berries had been eaten, and reports from several correspondents indicate that in rare instances considerable annoyance and loss may be occasioned by the Crow.

Blackberries and *raspberries* are noticeable in the Crow's diet only during July and August, and it is probable that most of the berries eaten are wild. Very few complaints of damage to cultivated blackberries or raspberries have been received, and it is doubtful if the Crows care enough for these fruits to lead them to pillage berry patches near houses. Unquestionable remains of raspberries are not common in the stomachs, and doubtless blackberries are most often eaten. Not only this, but it seems certain that the running blackberries, or dewberries, are most often taken, not because they are better flavored or more abundant, but because they are more accessible. As elsewhere stated, the Crow dislikes very much to alight in thickets, brush, or rank vegetation of any kind, and the high-bush blackberries are therefore almost inaccessible; they can not be reached from the ground, and the bushes are too slender and yielding to give support to so heavy and clumsy a bird; consequently the Crow contents himself with the low-running kinds or with the few high bush berries which chance to grow along fences or droop near the ground in places easily reached.

Apples are often eaten by Crows. Reference is not made here to the well-known habit of eating frozen apples which cling to the trees through the first half of the winter, but to attacks upon ripe or ripening fruit, particularly in August, September, and October. Remains of apples were not found in the stomachs as often as might be expected, but it should be remembered that unless the seeds or skin are swallowed it would be difficult to identify the source of fruit pulp that might be present, and in the case of juicy and tender apples very little pulp would remain undigested after the first half hour. On the other hand, the testimony of eyewitnesses is abundant as to certain specific instances of apple stealing, and in numerous instances seeds and skin were found. Reference to the table shows that in August nearly 4 percent of the stomach contents consisted of apples, in September about half of 1 percent, and in November almost 1 percent. In October no apple was positively identified in the stomachs, but it is noteworthy that more than half of 1 percent of unidentified fruit was found in October stomachs, and doubtless some of this was apple pulp.

An interesting note by F. C. Browne, of Framingham, Mass., appeared in Forest and Stream for August 25, 1880. Mr. Browne says: "A short time ago I happened to notice the almost daily visit of a small party of Crows to a certain tree in my apple orchard, and it occurred to me that the fruit might be the attraction, as it was a large, sweet, and tender variety. A visit to the tree proved my surmise to be correct. They had destroyed quite a number of apples by pecking out from a quarter to a half. When the stem would give way, the apple fell and another would be attacked. This may be nothing new, but in living on a farm constantly visited by Crows for nearly thirty years I have never had occasion to accuse them of this mischief before, though the indictment was strong enough without it."

Similar complaints have been received from other parts of Massachusetts, from Maine, Vermont, New York, and even from British Columbia.

Mr. Allan C. Brooks, of Chilliwack, British Columbia, writes: "Their worst offense is the destruction of apples. As soon as the salmon that ascend the river in the fall are all eaten, the Crows, which have congregated in immense flocks, attack the orchards in the vicinity. I have seen a fine orchard with seven-eighths of the apples broken into." The bird may have been the Northwest Fish Crow (*Corvus caurinus*) instead of the Common Crow.

In the fall of 1893 Mr. Clayton E. Stone, of Lunenburg, Worcester County, Mass., found the Crows eating Baldwin apples regularly, and samples were sent to the division for examination. On further investigation Mr. Stone found that the Crows visited the orchards in small parties, often in twos or threes, coming very quietly and usually early in the morning. So far as could be learned, no apples were carried away, but a great many were knocked off the trees, and many were pecked into and left to decay.

Several correspondents in eastern Pennsylvania and one in Virginia have known Crows to feed on pears, sometimes doing considerable damage.

Figs.—Crows are known to eat figs, but the evidence on this point is scanty at present. Very few stomachs were received from regions where this fruit is raised, and these contained no traces of figs. In California Mr. T. S. Palmer saw a flock of Crows feeding on figs at the Tejon Ranch, in Kern County, early in July. The birds frequented the orchard morning and evening, and several would often alight together on a tree and eagerly devour the ripening fruit. It was said that no small proportion of the crop was taken by Crows and other birds.

Crows are, however, comparatively rare in the southern part of the United States during summer, and this fact shows that such injuries are only local, and precludes the probability of any considerable loss on account of their fondness for figs.

Watermelons.—Complaints of injury to watermelons have been rather frequent, mainly from Kansas, Kentucky, Virginia, South Carolina, Georgia, Louisiana, and Texas, although there are enough from other States to show that the crop is likely to be attacked wherever grown.

The manner in which watermelons are pecked into without much of the pulp being eaten suggests the possibility that Crows attack this fruit mainly to satisfy their thirst, for all members of the Crow family are extremely fond of water.

Wild fruits.—With a few notable exceptions, the wild fruits eaten by Crows are of little consequence. Cherries, strawberries, grapes, raspberries, and blackberries have been mentioned already, and to these might be added huckleberries (*Gaylussacia*), blueberries (*Vaccinium*), Juneberries (*Amelanchier*), elderberries (*Sambucus*), both red and black mulberries (*Morus*), and in some localities barberries (*Berberis*) and bull berries or buffalo berries (*Shepherdia*). All these berries are more or less juicy and acid, and are taken commonly in small quantities. So far as our experience goes no one of them ever forms a large proportion of the Crow's food. Moreover, they ripen at seasons when other food is likely to be abundant, and excepting the barberry and bull berry none of them persist into the winter months. Certain other berries and small wild fruits, though apparently not more attractive in themselves, have the merit of clinging to the branches for a large part of the winter, and when other food is scarce the Crow resorts to them. Among these may be mentioned the poke berry (*Phytolacca*), Virginia creeper (*Ampelopsis*), holly (*Ilex*), haws (*Cratægus*), cedars (*Juniperus*), hackberry (*Celtis*), sour gum (*Nyssa*), cat brier (*Smilax*), and several species of *Cornus* and *Viburnum*, notably the flowering dogwood (*Cornus florida*). A few of these may be eaten at seasons when other food is plentiful, but ordinarily they are not touched until other sources of food supply become very scanty or fail entirely. In severe weather, or after unusually heavy or long continued snows, Crows are frequently found with their stomachs filled with the remains of poke berries, catbrier berries, and similar hard fare.

It is noticeable that the supply of these berries is very rarely exhausted, and yet in severe winters many Crows die at the roosts with every appearance of having starved to death.

Poisonous and harmless sumac.—Two other groups or genera of wild fruits should be mentioned, since they often serve to keep the Crow from starvation during snowy weather, while they form acceptable food at all seasons when obtainable. They are the sumacs (*Rhus*) and wax myrtle or bayberry (*Myrica*). The former genus comprises the harmless red-berried sumacs, the berries of which are decidedly acid and contain little nutritious matter, and the poisonous species *R. toxicodendron* and *R. venenata*, the berries of which contain considerable oily matter which apparently is very nutritious. As all these species of *Rhus*, poisonous and nonpoisonous, are widely distributed, very prolific, and their fruit strongly persistent, clinging to the bare twigs all through the winter, they furnish valuable food. This is particularly true of the poisonous species, the berries of which ordinarily are plumper and much richer in nutriment.[1] Crows eat all species of *Rhus*, and at all seasons, thus insuring the spread of these plants. The berries of the poisonous species are much preferred, and it is only as these become scarce that the harmless ones are much eaten. The average quantity of poisonous and harmless sumac berries consumed during the year is almost exactly the same, but most of the poisonous berries are eaten during late summer, autumn, and early winter, while most of the harmless berries are eaten during midwinter and toward spring, as shown by the following table:

Table showing percentages of sumac berries in Crow stomachs from August to April.

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Average for the year.
Harmless sumacs				4	5	6.58	9.96	0.89	0.74	2.27
Poisonous sumacs	0.5	3.4	8.46	6	4	3.89	.56			2.24

After eating these berries the Crow rapidly digests the nutritious pulp and ejects from the mouth the seeds, together with the sand swallowed to aid in digestion (see fig. 1). The subject of the winter food of Crows, as shown by the material found at the roosts, has already been discussed (see pages 21–24). It is only necessary to add that the seeds are not at all harmed by digestion of the surrounding pulp, and after expulsion from the stomach are in good condition to grow. By actual experiment it was found that more than 90 percent of such seeds germinated when planted.

In one case 153 seeds of poison *Rhus* were taken from a single Crow stomach in addition to much other food, and in numerous instances stomachs were found to contain from 90 to 130 of these poisonous seeds.

A caged Crow, well fed on grain and some animal food, ate poison-ivy berries whenever offered, although he refused berries of the smilax and those of the harmless red-berried sumacs unless very hungry. After eating 50 or more berries of the poison *Rhus* this Crow ejected the seeds, perfectly clean and devoid of pulp, in rather less than forty minutes, after which he was willing to eat more berries. These facts indicate that under ordinary circumstances a single Crow might distribute several hundred seeds of poison *Rhus* in the course of a day, with a fair prospect that many, if not most of the seeds, would germinate and live.

The bayberry or wax myrtle (*Myrica cerifera*) is an abundant shrub along the Atlantic Coast from Maine to Florida, but its range does not extend inland very far, except in the neighborhood of the St. Lawrence River and lakes Ontario and Erie. The berries or fruits have a waxy pulp similar to that surrounding the seeds of the poisonous *Rhus*, but richer in waxy or oily matter. Crows appear to like this fruit very much, and the stomach examinations show that in August and September it formed rather less than 1 percent of their food, increasing to 1½ percent in October, and exceeding 4 percent in November, after which time it did not appear in the stomachs. The shrub is well known as a harmless, aromatic bush of no particular importance, but the fruit was formerly used in the manufacture of wax for candles, whence it received the name of candleberry, by which it is still known in some places.

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[1] *Rhus venenata*, the most poisonous species, is known as poison sumac, poison elder, poison dogwood, and swamp dogwood, while *Rhus toxicodendron* is variously known as poison ivy, poison oak, poison creeper, and poison vine.

CHAPTER V.

PROTECTION OF CROPS.

The early settlers of New England and Virginia were confronted with the problem of protecting their crops from Crows and blackbirds, and from that time until the present the farmers of the eastern United States have been compelled annually to meet the same enemies to grain. Naturally the first attempt at protection looked toward the extermination of the offending birds, pending which the crops were guarded as well as possible by watchers (ordinarily children) or by 'scarecrows' and other devices intended to frighten the birds away. Precisely the same methods had been pursued for centuries in the Old World and are still in use in our own country. The efforts of the early colonists were comparatively fruitless, owing partly to the small area of cultivated land and partly to the lack of adequate means of destruction, such as breech-loading guns and cheap poisons. To encourage the destruction rewards were offered in many towns, while in others each head of a family was compelled to kill a certain number of Crows or blackbirds yearly; in case of failure a fine was imposed proportioned to the number lacking. "The records of the different towns show that large sums were often paid in premiums for the destruction of Crows and blackbirds. * * * In Norwich, Conn., early in the eighteenth century a half-penny a head was paid for every blackbird or Crow killed in the town, and though the amount offered was so small, it is stated that it formed a considerable item of expense to the town."[1]

That such persecution was not without effect is a matter of history, and the same writer goes on to say: "The traveler Kalm relates that Dr. Franklin told him in 1750 that in consequence of the premiums that had been paid for killing these birds [Crows and blackbirds] in New England they had become so nearly extirpated that they were very rarely seen and in few places only. In consequence of this exterminating warfare on the 'maize thieves,' the worms that preyed upon the grass increased so rapidly that in the summer of 1749 the hay crop was almost wholly cut off by them, the planters being obliged to bring hay from Pennsylvania, and even from England, to Massachusetts to meet the deficiency caused by the worms." It should be noted, however, that the statement as above quoted is not precisely as Kalm wrote it. He was careful not to state that the worms increased as a consequence of killing the birds, but only that the people believed that to be the case.

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[1] J. A. Allen, The Penn. Monthly, December, 1876, pp. 941–942.

His words are: "But as, in the summer of the year 1749, an immense quantity of worms appeared on the meadows, which devoured the grass, and did great damage, the people have abated their enmity against the maize thieves, for they thought they had observed that those birds lived chiefly on these worms before the maize is ripe, and consequently extirpated them, or at least prevented their spreading too much."

It is to be presumed that such invasions of insects had a wholesome effect in checking the too general slaughter of the birds, and it is probable that thereafter the colonists contented themselves more largely with efforts to frighten the birds away from their crops.

It is unnecessary to describe the various methods resorted to. The use of 'scarecrows' was perhaps the most common, but unless Crows were less intelligent than at present this method could not have been effective for any length of time. Small windmills, so adjusted as to turn watchman's rattles or otherwise make loud noises, were often used, and also benches of jingling tins and sheet iron, suspended from poles and moved by the wind. Single Crows were shot and hung up as a warning to the rest, and in some cases doubtless served the purpose intended. One of the commonest means employed was to encircle each field with a white string, supported at intervals on poles of various heights, and, in case the field was large, crossing it several times with the string. In many cases this simple measure was sufficient to keep the Crows off altogether, doubtless because they suspected that the string was part of a system of snares. This plan, somewhat modified, is still used in many parts of the country, and is more or less efficacious. By crossing fields in two directions with strings, so as to form a network, even though the meshes are many yards in diameter, complete protection from Crows can be secured, but there are better ways—ways requiring less time and expense.

TARRING CORN.

For many years it has been known that Crows, blackbirds, and bobolinks or rice birds dislike the flavor of tar of any kind, and in many parts of the country advantage of this fact has been taken to prevent the pulling of corn and other grain after planting. Each kernel of seed grain is more or less completely covered with tar, or some preparation of tar, so that the flavor is imparted to the kernel and is not lost entirely for several weeks. In fact, it is found that in shoots of rice which grow from seed thus treated the flavor of the tar can be detected plainly until the green blades are 8 or 10 inches high and too strongly rooted to be easily pulled up by birds.

Just when and how this important discovery was made is not known, but the practice of tarring seed corn before planting has been in common use in Maryland and Virginia for nearly or quite a century, and it is rather remarkable that it has not been adopted in all parts of the country where Crows are troublesome. The earliest reference to it, so far as we know, occurs in Dr. John D. Godman's 'Rambles of a

Naturalist,' published in 1833. Dr. Godman's account of the Crows' attacks on the newly planted corn and the method of preventing serious damage is so interesting that it is given almost entire. He says: "Woe betide the cornfield which is not closely watched, when the young grain begins to shoot above the soil! If not well guarded, a host of these marauders will settle upon it at the first light of the dawn, and before the sun has risen far above the horizon, will have plundered every shoot of the germinating seed, by first drawing it skillfully from the moist earth by the young stalk, and then swallowing the grain. The negligent or careless planter, who does not visit his field before breakfast, finds, on his arrival, that he must either replant his corn or relinquish hopes of a crop; and without the exertion of due vigilance he may be obliged to repeat this process twice or thrice the same season. Where the Crows go to rob a field in this way they place one or more sentinels, according to circumstances, in convenient places, and these are exceedingly vigilant, uttering a single warning call, which puts the whole to flight, the instant there is the least appearance of danger or interruption. Having fixed their sentinels, they begin regularly at one part of the field, pursuing the rows along, pulling up each shoot in succession, and biting off the corn at the root. * * *

"Numerous experiments have been made, where the crows are thus injurious, to avert their ravages; and the method I shall now relate I have seen tried with the most gratifying success. In a large tub a portion of tar and grease were mixed, so as to render the tar sufficiently thin and soft, and to this was added a portion of slaked lime in powder, and the whole stirred until thoroughly incorporated. The seed corn was then thrown in, and stirred with the mixture until each grain received a uniform coating. The corn was then dropped in the hills, and covered as usual. This treatment was found to retard the germination about three days, as the mixture greatly excludes moisture from the grain. But the Crows did no injury to the field; they pulled up a small quantity in different parts of the planting, to satisfy themselves it was all alike; upon becoming convinced of which, they quietly left it for some less carefully managed grounds, where pains had not been taken to make all the corn so nauseous and bitter."

Dr. Godman saw this method used in Anne Arundel County, Md., probably about the year 1800, and essentially the same plan is still in use in the same vicinity. In neighboring States tar in some form—coal tar, gas tar, or wood tar—is used with equally good effect.

Mr. Marcus S. Crane, of Caldwell, Essex County, N. J., describes the method practiced in his vicinity as follows: "Most farmers in this section have adopted the coal-tar method, viz: Before planting, a half bushel or more of corn is put in a vessel, slightly moistened with warm water, and enough coal or gas tar dropped in to give each kernel a thin coating when stirred; after this, plaster of paris is stirred in until the corn is nearly white. When this plan is used, Crows will not injure corn after they pull a little and find what is on it."

Mr. J. V. Henry Nott, of Kingston, N. Y., says: "I soak the seed over night, and after draining off the water thoroughly, stir the tar in it by dipping a small stick in the tar and vigorously stirring the seed with it until all is a brown color, after which I stir in plaster until the seed looks like sugar-coated pills. The only objection is that a planter can not be used."

Hon. C. L. Merriam, of Locust Grove, Lewis County, N. Y., writes: "Last year my farmer planted an 11-acre lot with corn, but being out of sight the Crows took it all. This year he poured the seed corn into tar oil, didn't soak it, but took it out and rolled it in wood ashes, and then planted it. Crows opened two hills, didn't like the taste or smell, and let the rest alone. Persons who have soaked corn in tar oil say it kills the germ."

The objections usually raised to the 'coal-tar method' are three: (1) It retards germination; (2) it renders the seed corn so sticky that it must be planted by hand instead of by a planter; (3) it is too much trouble to prepare and plant the seed in this way. The last objection naturally is unanswerable, but the first can be easily overcome by soaking seed for a short time before coating with tar. In this way the growth of the germ is started by the moisture absorbed and the seed will continue to swell and sprout.

As to the use of a mechanical planter, there is little doubt that the difficulty can be overcome by careful experiments. Air-slaked lime, ashes, powdered earth, or any fine dry powder can be used as an absorbent in place of plaster of paris, and with a little extra care no difficulty should be found in using the planter. It is more than probable that some preparation of tar could be made which would not be sticky and yet carry all the qualities offensive to birds. Tar oil is effective, and very likely creosote, or even crude carbolic acid properly diluted would be equally so. This line of experiment is suggested as a promising one for some experiment station favorably situated.

USE OF POISON.

In some parts of the Eastern States, Crows have been poisoned in considerable numbers. It is an easy matter to poison a few Crows, but the general disappearance which so often follows the use of strychnine must be attributed mainly to the Crows' intelligence; the mysterious death of a few serving as a warning to the many survivors, who promptly quit the locality. This fact has been repeatedly observed. Dr. Charles E. McChesney states: "At Fort Berthold, N. Dak., where I observed it in numbers in the spring of 1873, doing much damage to the young corn and other parts of the crop, it was quickly driven from the vicinity by poisoning corn and sprinkling it around the scene of their operations, and although only a few dead birds were discovered, the survivors took the hint and left for a more agreeable abode."[1]

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[1] Bull. U. S. Geol. and Geogr. Surv. Terr. V, No. 1, 1879, p. 80.

George C. Benson, of West Belleville, Ill., writes: "We used to kill rabbits, salt them well with arsenic, and tie them on some fence stake with wire; the Crows would get their flesh and take some to their young, and then for years no Crows would alight in our fields."

Dr. W. C. Brownell, of Plymouth, Mich., wrote in 1891: "As an experiment I soaked 1 pound of common dent corn for several days (two or three, I have forgotten which) in a solution of *Hyoscyamus niger* (homeopathic tincture) and water. When the corn began to swell, I dried out the excess of liquid and mixed the corn in some fine horse manure and took the whole into a pasture lot near a dead sheep where I knew the Crows came every day. Several days later I found four dead birds in a grove half a mile distant, and the Crows never came back to the sheep."

Incidents like these show how readily the Crow may be frightened away by the use of poison, even when comparatively few are killed. Several correspondents have stated that sprouting corn may be protected by strewing good corn on the surface of the ground. One person writes from Mount Carmel, Mo.: "Young corn may be effectually protected by feeding the birds boiled corn or soaked corn, sown broadcast, 2 quarts to 10 acres. The damage to matured crops is inconsiderable in this locality."

Another writes from Bucks County, Pa.: "Samuel Hart, of Doylestown, protects his cornfield every spring against Crows by simply scattering some loose grain every day around his entire field of 10 acres; every other day will answer, provided the supply is not exhausted. This method has been practiced with entire success for many years, and though Crows are very numerous no corn is pulled up. The entire cost, as estimated by Mr. Hart, is the time required and a total of half a bushel of corn."

BOUNTIES.

As previously stated, bounties were resorted to by the earliest settlers of the country in their efforts to lessen the numbers of Crows and blackbirds. Apparently the plan was moderately successful. Nevertheless, then as now the offer of a bounty for the heads of any undesirable species proved a severe tax on the people who paid it, and whenever the abatement of the evil warranted it the bounty was at once withdrawn. Even when the bounty was very small—not more than 1 cent (a halfpenny) per head—the sums required to pay the rewards became so great that in many instances the repeal of the laws became necessary, and it was found better to compel each citizen to kill a specified number of blackbirds or Crows each year.

Dr. Godman, already quoted, states that "about the years 1800–1804 the Crows were so vastly accumulated and destructive in the State of Maryland that the Government, to hasten their diminution, received their heads, in payment of taxes, at the price of 3 cents each. The storekeepers bought them of the boys and shooters who had no taxes to pay, at a rather lower rate, or exchanged powder and shot for them. This measure caused a great havoc to be kept up among them, and in a few years so much diminished the grievance that the price was withdrawn."

At intervals, however, bounty laws have been revived in Maryland, Virginia, Pennsylvania, and in fact in nearly all the Eastern States, and when the State did not pay a bounty, in very many cases counties or towns did so, with the result that in one part of the country or another the Crows were always subject to persecution. Even at the present time bounties are paid in many parts of the United States, sometimes for Crows alone, more often for various birds and animals which, with or without reason, are believed to be pests.

In December, 1890, Mr. Robert C. Alexander, of Stark, Wayne County, Mich., wrote as follows to the Department: "For the last four years (1887–1890) this town has given a bounty of 10 cents a head on woodchucks (*Arctomys*), Crows, and all species of hawks, and 5 cents a head on the common gopher (*Spermophilus 13-lineatus*) and the common mole (*Scalops aquaticus*). This has taken about $100 out of the treasury each year, and as far as I can see it has not decreased the numbers in any case. Last year the Crow was more abundant than it has been before in a great many years."

Dr. W. C. Brownell, of Plymouth, Sheboygan County, Mich., wrote in 1891: "Several townships in this immediate vicinity offer a bounty on heads and eggs, with the result of large numbers of Crows being killed and many nests broken up."

In 1889 the legislature of Maine enacted as follows:

> SECTION 1. A bounty of ten cents for every Crow killed in any town in this State between the thirty-first day of March and the first day of November of each year, shall be paid by the treasurer thereof, to the person depositing (in lots of ten or more) the heads of the same with such treasurer. The treasurer shall immediately destroy such heads.
>
> SEC. 2. Towns shall be reimbursed from the State treasury, etc.

One thousand dollars was appropriated by the legislature for the payment of bounties in 1889 and a similar amount for 1890. At the close of 1889 it was found that $2,200 would be required to pay for Crows already killed, and it may well be doubted whether the number of Crows in the State had been perceptibly diminished.

The number of Crows gathering nightly at an average winter roost in Maryland or Virginia certainly exceeds 100,000, and many roosts are known to accommodate double that number. The Maine law wisely limited the bounty to Crows taken during spring, summer, and autumn, and thus probably was doubly effective; yet it is doubtful whether any State east of the Mississippi is able to pay 10 cents each for all the Crows which nest within its boundaries. As a matter of fact, it is certain that not more than half the Crows could be killed by the offer of such a bounty, and so soon as the survivors became too wary to be easily secured their pursuit would be generally abandoned and the species would reestablish itself.

It seems probable that in most places the Crow is neither so harmful nor so valuable as to render special laws necessary for its destruction or protection, but from a purely economic standpoint the attempt to rid a State of Crows by bounties or any other means must prove either a complete failure or a most expensive success.

APPENDIX.

LIST OF LOCALITIES AT WHICH CROW STOMACHS WERE COLLECTED.

	Number of stomachs.	
Alabama:		
Greensboro	4	
Hale County	1	
		5
California:		
Visalia		1
Connecticut:		
East Hartford	23	
Portland	7	
Rockville	1	
		31
Delaware:		
Cheswold	2	2
District of Columbia:		
Brookland	11	
Washington	136	
		147
Florida:		
Fort Drummond	1	
Micco	1	
		2
Georgia:		
Calhoun		1
Illinois:		
Jacksonville		1
Indiana:		
Argos	1	
Farmland	14	
Waterloo	1	
		16
Iowa:		
Boone County	2	
Gilbert Station	2	
Sabula	3	
Scott County	8	
		15
Kansas:		
Onaga	27	
Zarah	2	
		29
Kentucky:		
Union County	6	6
Maine:		
Clinton	17	
Gorham	2	
Winslow	1	
		20
Maryland:		
Aikin	2	
Easton	5	
Marshall Hall	1	
Montgomery County	312	
Principio Creek	1	
Seabrook	1	
		322
Massachusetts:		
Amherst	1	
Raynham	2	
Wilmington	1	
Worcester	2	
Lunenburg	7	
		13
Michigan:		
Livonia	2	
Redford	1	
Wayne County	29	
		32
Missouri:		
St. Louis		1
Montana:		
Bozeman	2	2
Nebraska:		
Everett	6	6
New Jersey:		
Alton	1	
Englewood	1	
Horse Hill	1	
Morristown	5	
Wigger Pond	2	
Pecks Island	1	
Schraalenburg	2	
Vineland	1	
		14
New York:		
Alder Creek	2	
Alfred Center	18	
Broadway	1	
Buffalo	2	
Chautauqua County	2	
Hammondsville	1	
Lake George	1	
Lake Grove	1	
Peterboro	5	
Rockaway	3	
Selden	1	
Shelter Island	6	
Sing Sing	15	
Smithboro	1	
Watkins	2	
Westerville	34	
Winfield	1	
Youngs	7	
		103
North Dakota:		
Fort Buford	4	4
Ohio:		
Austinburg	4	
Mount Airy	1	
New Concord	1	
Oxford	14	
		20

	Number of stomachs.	
Oregon:		
Creswell		1
Pennsylvania:		
Beaver	9	
Berwyn	1	
Chester County	4	
Ercildoun	1	
Fallston	1	
Herrick	4	
Lower Providence	1	
Montgomery County	2	
Vanport	1	
		24
South Dakota:		
Vermillion	4	4
Tennessee:		
Warner	3	3
Texas:		
Eastland		1

	Number of stomachs.	
Vermont:		
Essex Junction	1	
Manchester Center	2	
Rutland County	30	
		33
Virginia:		
Alexandria	18	
Drewrys Bluff	20	
Gainesville	2	
		40
Wisconsin:		
Bears	1	
Darien	1	
Delavan	1	
Oregon	3	
		6
New Brunswick:		
Hillsboro	4	4
Total		909

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